SEMESTER: I

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code	Course Name		L	T	P	C
UCLEC01	Technical English - I		2	0	0	2
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		2 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	√					
	Basic Science	Engineering Science	Open Elective		Mandatory	

Course Objectives	1. To make the students learn to speak grammatically correct English. Guiding and supporting their skill development –Listening, speaking, reading and writing in English. 2. Making them realize the importance of English as Global language and its importance in today's scenario.
Course Outcomes	After successful completion of Course, the students will be able to 1. Outline the importance of technical English. 2. Illustrate technical and general vocabulary. 3. Distinguish different tenses and identification of common errors 4. Infer the skill for writing formal and informal letters 5. Develop good listening and speaking skills 6. Apply the skills to speak and write English grammatically

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	3	3	-	2	2	-	3	-	-	-
CO3	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO4	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO5	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
CO6	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-
AVERAGE	-	-	-	-	-	2.5	2.5	-	2.67	2.67	-	2.83	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT 1: COMMUNICATION SKILL & READING SKILL **6 Hrs**

Importance of Technical Communication-Topic sentence and its Role-Reading and Interpretations-Critical Reading -Creative and Critical Thinking-Note Making -Transfer of Information-Visual Aids-Graphics-Lab.

UNIT II: FOCUS ON LANGUAGE – VOCABULARY **6 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases-Homophones-Technical Vocabulary-Words commonly misspell –Lab-Test.

UNIT III: ENGLISH GRAMMAR **6 Hrs**

Parts of Speech-Subject Verb Agreement-Tenses, Articles, Prepositions-Common errors in English-Lab-Test.

UNIT IV: WRITING SKILL **6 Hrs**

Descriptive Writing –Paragraph-Technical descriptions-Essays-Letter Writing – Formal and Informal-Business Letters-Job Application Letter-Types of reports-Instructions and Checklists- Lab-Test.

UNIT V: LISTENING AND SPEAKING **6 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation Lab.

TOTAL: 30 Hours

TEXT BOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Essential Grammar in use- Raymond Murphy, Cambridge, 2007.
2. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
3. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
4. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
5. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
6. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UBMTC01	Course Name Engineering Mathematics-I		**L** 3	**T** 1	**P** 0	**C** 4
Year and Semester	I Year & I Semester		Contact Hours Per Week 4 Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
	√					
Course Objectives	1. To know the application of analytical geometry and understanding shapes of three dimensions. 2. To understand the techniques of differentiating a function. 3. To acquaint the student with function of several variables. 4. To introduce the concepts and methods to solve the integrals. 5. To understand the application of integrals.					
Course Outcomes	After successful completion of Course, the students will be able to 1. Solve the problems using three-dimensional analytical geometry. 2. Apply the theorems and formulae for solving problems in differential calculus. 3. Classify the functions of several variables 4. Apply integral calculus on engineering problems. 5. Use multiple integrals to solve problems 6. Apply the concepts of Calculus and analytical geometry for engineering applications					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO5	2	2	2	2	2	-	-	-	-	-	-	1	-	3	3
CO6	3	3	3	2	2	-	-	-	-	-	-	2	3	3	3
AVERAGE	2.7	2.7	2.7	2	2	-	-	-	-	-	-	1.8	2.3	2.4	2.4
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: THREE DIMENSIONAL ANALYTICAL GEOMETRY **12 Hrs**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT- II:- DIFFERENTIAL CALCULUS **12 Hrs**

Differentiation of algebraic – circular - exponential and logarithmic functions of products and quotient – Functions of a function and simple implicit functions – Successive differentiation- introduction and notation – nth order derivatives of standard functions – nth order derivatives using trigonometric identities and standard functions and partial fractions – Leibnitz theorem – Maclaurin‘s Theorem and standard expansions – Taylor‘s theorem – Indeterminate forms and L‘Hospital‘s rule.

UNIT- III:- FUNCTIONS OF SEVERALVARIABLES **12 Hrs**

Limits and continuity-Partial derivatives – definition-geometrical interpretation and rules of partial differentiation – Higher order partial derivatives – Homogeneous functions – Euler‘s theorem for homogenous functions – Total derivatives and chain rules – Differentiation of implicit functions and composite functions – Maxima and Minima– Method of Lagrangian multipliers.

UNIT- IV:- INTEGRAL CALCULUS **12 Hrs**

Integration by trigonometric substitution – The definite integral as the limit of a sum- Bernoulli's rule – Reduction formulae – Properties of definite integrals – beta and gamma Functions and problems – Work done by variable forces – mean values – Root mean square values of in sin x and Cos nx.

UNIT –V:- MULTIPLE INTEGRALS **12 Hrs**

Double and triple integrals – Cartesian coordinates – Region of integration and change of order of integration – Spherical polar and cylindrical coordinates Theorems of parallel and perpendicular axes. Applications – Area – Volume - Mass of wire - lamina and solid - Centre of Gravity of wire – lamina and solid – Moment of Inertia using multiple integrals.

TOTAL : 60 Hours

TEXT BOOKS:

1. Bali N. P and Manish Goyal, ―Text book of Engineering Mathematics, Third edition, Laxmi Publications (p) Ltd., 2008.

2. Grewal. B.S, ―Higher Engineering Mathematics, 40th Edition, Khanna Publications, Delhi, 2007.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma,” Higher Engineering Mathematics”, S. Chand Private Ltd.,2011.

2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2012.

3. Peter V. O’Neil,” Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.

4. Ramana B.V, “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, NewDelhi, 2008.

5.Sivarama Krishna Das P. and Rukmangadachari E., “Engineering Mathematics”, Volume I, Second Edition, PEARSON Publishing, 2011.

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code	Course Name		L	T	P	C
UCPHC01	Engineering Physics-I		3	0	0	3
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		3 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	√					

Course Objectives	1. To understand the basic mechanics of solids and fluids, their properties and applications. 2. To learn the basic principles of Electromagnetic induction, Electricity and electrical machines.
Course Outcomes	After successful completion of Course, the students will be able to 1. Summarize the laws and principles of basic mechanics 2. Explain the concepts of hydrostatics and hydrodynamics 3. Illustrate the properties of matter 4. Demonstrate the basic principles of heat and light 5. Outline the basic principles of electricity and electrical machines 6. Apply the fundamentals of electromagnetic induction for engineering applications

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
AVERAGE	2.33	2.17	2.17	1.67	2.33	-	-	-	-	-	-	2.2	2	2.33	2.17
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: MECHANICS **9 Hrs**

Force-inertia – Newton`s laws of motion- impulse and impact – Friction – cause of friction – types of friction – laws of friction – coefficient of friction – angle of friction. Motion-types of motion – simple harmonic motion – simple pendulum – circular motion –centripetal and centrifugal force – conical pendulum-working of a steam engine governor based on the principle of conical pendulum. Newton`s law of universal gravitation – Satellite-principle of launching of satellite – orbital velocity – time period – escape velocity. Planetary motion and Kepler's Laws – Deduction of Kepler`s third law – Law of gravitation from Kepler`s third law.

UNIT II: HYDROSTATICS AND HYDRODYNAMICS **9 Hrs**

Fluid-Pascal`s law – Archimedes principle – Laws of floatation – centre of buoyancy – stability of equilibrium of a floating body – metacentre – metacentric height of a ship – experiment. Hydrostatic pressure, differential manometer – Centre of pressure – Centre of pressure of a rectangular lamina

immersed in a homogenous liquid at rest – Centre of pressure of a triangular lamina with one side parallel to the surface-Surface tension – angle of contact – capillarity – derivation of surface tension. Viscosity – Viscous Force-Stokes Law – coefficient of viscosity – experiment to find coefficient of viscosity. Bernoulli's Theorem – Venturimeter – Plimsol lines.

UNIT III: PROPERTIES OF MATTER **9 Hrs**

Elasticity- stress and strain – Hooke`s law – modulus of elasticity – different types – Poisson ratio Torsion – torque per unit twist – work done in twisting – Torsion pendulum – theory and experiment – bending of beams – bending moment – Cantilevers – depression of a cantilever – non uniform bending and uniform bending – theory and experiment.

UNIT IV: HEAT AND LIGHT **9 Hrs**

Laws of thermodynamics – Specific heat capacity – Specific heat capacity of gases – CP and CV – Relation between them – Transmission of heat – conduction – coefficient of thermal conductivity – Lee,s disc experiment – cylindrical flow of heat – convection – radiation – Black body radiation – distribution of energy – Wien`s displacement law– Rayleigh Jeans law. Interference – Double slit experiment-Diffraction due to single slit and circular aperture. Limit of resolution, Resolving power of optical instruments.

UNIT V: ELECTRICITY **9 Hrs**

Heating effect of current – Joules law of heating – Applications – fuse – thermopile. Ampere`s Law, Biot Savart law – Magnetic field at a point due to straight conductor carrying current – Kirchhoff's current and voltage laws – Whetstone's network – Electromagnetic induction – Faraday's laws of Electromagnetic induction – Lenz law – Self induction – Mutual induction . DC Generator – principle, construction and working – AC Generator – principle, construction and working. Transformer – principle, construction and working – Losses in transformer – methods to reduce the losses.

TOTAL: 45 Hours

TEXT BOOKS:

1. A Nelson, "Engineering Mechanics" Tata McGRaw Hill, 2009
2. M. Narayanamurthi, M. Nagarathnam, "Statics, Hydrostatics and Hydrodynamics", The National Publishing Company, 8th Edition, 2008.
3. R. Murugeshan, Properties of matter and acoustics, S. Chand & Co, New Delhi 2012.
4. D.S. Mathur, Elements of properties of matter, S.Chand & Company Ltd., New Delhi 2010.
5. Brijlal, N. Subramanyam and P.S. Hemne "Heat and thermodynamics", S.Chand & Co, New Delhi 2008.
6. N. Subramanian, Brijlal and M.N. Avadhanulu, A text book of Optics, S. Chand & Co, New Delhi, 2012.

REFERENCES:

1. R Feynmann, R Leighton, M Sands, "The Feynmann Lectures on Physics", Volume 1, Pearson Education; 1st edition 2012.
2. D Halliday, R Resenic and J Walker "Fundamentals of Physics", Wiley India, 6th edition, 2006.
3. Brijlal and Subramaniyam, "Properties of matter", S. Chand & Co, New Delhi, Revised edition,2008.
4. R W. Fox, A T. McDonald, P J. Pritchard John, "Introduction to Fluid Mechanics", Wiley & Sons, 6th edition, 2008.

5. E M. Purcell and Morin, “Electricity and Magnetism”, 3rd Edition, Cambridge University Press, 2011
6. A Ghatak, “Optics”, McGraw-Hill Education; 1st Edition, 2009

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code	Course Name		L	T	P	C
UBCHC01	Engineering Chemistry		3	0	0	3
Year and Semester	I Year & I Semester		Contact Hours Per Week			
Prerequisite course	Nil		3 Hrs			
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
	√					

Course Objectives

1. To impart a sound knowledge with respect to Phase rule, Hazardous Chemicals, and treatment of water for industrial purpose.
2. To understand principle involved in corrosion control, the concept of energy storage devices and the importance of fuels.
3. To develop polymer based materials and functional materials towards different applications.

Course Outcomes

After successful completion of Course, the students will be able to

1. Illustrate the fundamentals of phase rule and reduced phase rule
2. Outline the concepts of water treatment techniques
3. Identify the types of fuels and characterization of various constituents
4. Illustrate the basic principles of electrochemical reactions and redox reactions
5. Distinguish the production technologies of metallic and non-metallic materials
6. Make use of corrosion Control techniques in on- board ship

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	2	-	-	-	-	1	2	-	-
CO2	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO3	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO4	2	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO5	3	2	-	-	-	-	3	-	-	-	-	1	2	-	-
CO6	3	2	3	-	2	-	3	-	-	-	-	1	2	-	-
AVERAGE	2.33	2.00	3.00	-	2.00	-	2.83	-	-	-	-	1.00	2.00	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT- I PHASE RULE 9 Hrs

Terminology-Phase rule – one component system, reduced phase rule – application of reduced phase rule to binary alloy system-Hazard of Inorganic, Organic cargos carried on board vessels with respect to flammability, toxicity, reactivity and solubility.

UNIT- II WATER & IT TREATMENTS 9 Hrs

Sources of water - hard and soft water-determination of hardness - Softening of water - lime soda process Ion exchange process - Boiler feed water - removal of oil - blow down operation - Caustic Embrittlement -Internal conditioning - Water for domestic purposes screening - aeration, sedimentation, Chlorination, break point chlorination - Disinfection with ozone – desalination - Waste water treatment- marine sediments.

UNIT -III FUEL & COMBUSTION 9 Hrs

Conventional & non-conventional energy resources and energy conversion - classification and properties of fuel - calorific value determination using bomb calorimeter - Solid fuels – Analysis - proximate and ultimate analysis, hydrogenation & carbonization of coal - Liquid fuels - characterization of various constituents viz petrol diesel with regard to their application in IC engine (knocking)Gaseous fuels- coal gas, producer gas, biogas, water gas and flue gas analysis using Orsat apparatus - Toxic and other ill effects of cargos on human and environment.

UNIT -IV ELECTROCHEMISTRY 9 Hrs

Electrodes - Standard & single electrode potential - Nernst equation - Cell terminology - cell reaction - Galvanic cells - fuel cells - Lead acid battery - Nickel cadmium battery - Electrochemical Reaction: Electrolysis - Electroplating – galvanizing - Corrosion Control on Board Ship: Thermodynamics & Kinetics of corrosion - various forms of corrosion - corrosion prevention methods.

Lubricants: Classification and properties of lubricating oils (Viscosity, flash, fire point & cloud and pour points) Effects of pressure on melting & boiling point - Relevance of gas laws to LPG carrier and reefer ships. Physical and Chemical Properties of Fuels and Lubricants - Production of Oils from Crude Oil - Properties and characteristics of fuels and lubricants - Shore side and shipboard sampling and testing - Interpretation of test results - Contaminants including microbiological infection - Treatments of fuels and lubricants including storage, centrifuging, blending, pretreatment and handling.

UNIT- V 9 Hrs

Production of steel - Bessemer converter process - Open hearth process - Chemical addition to steels production of non-ferrous alloys, brass, bronze, aluminum alloys - Special reference to ship building (ship propellers etc) – Cement - manufacturing of cement - setting & hardening of cement – concrete - reinforced concretes - Basic Metallurgy - Metals and Processes - Properties and Uses - Non-Metallic Materials - Characteristics and limitations of process used for fabrication and repair – Process - Heat Treatment of Carbon Steel - Technology of Material - Metallurgy of Steel and Cast Iron - Properties and application of material used in machinery on board ship.

Organic Compounds: Hydrocarbon- petroleum & its fractionated products - extraction of aromatic compounds from Petroleum - Aromatic compounds – Benzene - polycyclic hydrocarbons- Naphthalene, anthracene, Naphthacene - Fiber and Reinforced plastics.

Total: 45 Hours

TEXT BOOK:

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.

PROGRAM	BE-Naval Architecture & Offshore Engineering

Course Code	Course Name:		L	T	P	C
UBMCCPA	Engineering Graphics		0	2	2	3
Year / Semester	I Year & I Semester		Contact hours per week			
Prerequisite course	Nil		4 Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
		√				
Course Objective	1.Develop the ability of students to understand graphic skills for communication of concepts. 2. To analyze and design ideas of engineering products.					
Course Outcome	After the successful completion of the course, the students will be able to: 1. Identify the three Dimensional objects in two-dimensional media 2. Construct the projection of points, straight lines and determination of true length and true inclination 3. Illustrate the simple solid on plain surface 4. Demonstrate the projection of solids and development of surfaces 5. Construct the isometric projection of simple solids 6. Examine the different isometric views and projections					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	-	-	1	-	-	-	-	-
CO2	3	3	2	3	1	-	-	-	-	2	-	-	-	2	-
CO3	2	2	3	2	2	-	-	-	-	3	-	-	-	2	-
CO4	3	3	2	2	1	-	-	-	-	1	-	-	3	-	-
CO5	3	2	2	3	3	-	-	-	-	2	-	-	2	-	2
CO6	3	3	2	2	3	-	-	-	-	3	-	2	-	-	2
AVERAGE	2.67	2.50	2.17	2.33	2.00	-	-	-	-	2.00	-	2.00	2.50	2.00	2.00

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT-I PLANE CURVES AND ORTHOGRAPHIC VIEWS **12 Hrs**

Introduction-Use of drafting instruments-Drawing conventions-size-Line types-Lettering and dimensioning Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves Visualization concepts: Representation of Three Dimensional objects in two dimensional media-Visualization of objects from pictorial views to orthographic views

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **12 Hrs**

Orthographic projection: Principal views and principal planes of projection-First angle projection- Third angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes -Determination of true lengths and true inclinations by rotating line method-Projection of plane surfaces

UNIT III PROJECTION OF SOLIDS **12 Hrs**

Projection of simple solids placed in Different positions-perpendicular to HP or VP-parallel to either HP or VP and inclined to the other-Inclined to both VP and HP

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **12 Hrs**

Sectioning of simple solids in simple vertical position when the cutting plane is inclined to the one of the principal planes-Development of lateral surfaces of simple solids by Parallel line method and radial line method

UNIT V ISOMETRIC PROJECTION AND ISOMETRIC VIEWS **12 Hrs**

Principles of isometric projection-isometric projection of simple solids-Guide lines to read the isometric view visualizing of plane surfaces inclined to the direction of view.

TOTAL : 60 Hours

TEXT BOOKS:

1**.**Bhatt N.D. and Panchal V.M., Engineering Drawing., Charotar Publishing House, 50th Edition, 2010.

2.Gopalakrishna K.R., Engineering Drawing. (Vol. I & II combined), Subhas Stores, Bangalore, 2007.

3.Luzzader, Warren.J. and Duff,John M., Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005

REFERENCES:

1.Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2009.

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCITC01	Introduction to Programming in C and C++	**L**	**T**	**P**	**C**
		3	0	0	3
Year / Semester	I Year & I Semester	Contact hours per week 3 Hrs			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
		√			
Course Objective	1. To explain the problem solving concepts using a computer. 2. To develop problem solutions for the computer by using problem solving tools. 3. To describe the Programming structure of C language. 4. To convert an Algorithm, Pseudo code and Flowchart into a C program. 5. To find errors and execute a C program.				
Course Outcome	After the successful completion of the course, the students will be able to: 1. Outline the basic organization of computer and introduction to number system 2. Demonstrate problem-solving concepts of C language 3. Explain the concepts of arrays and strings 4. Illustrate the functions and pointers of C Language 5. Develop syntax for writing programs in C language 6. Infer the knowledge of computer and programming in C				

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	2	-	-	-	-	-
CO4	2	2	2	-	1	-	-	-	-	2	-	-	-	-	-
CO5	2	2	2	-	3	-	-	-	-	2	-	3	-	-	-
CO6	3	3	3	2	3	-	-	-	-	2	-	2	-	-	-
AVERAGE	2.50	2.50	2.33	2.00	2.00	-	-	-	-	2.00	-	2.50	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: INTRODUCTION 9 Hrs

Generations and Classification of Computers - Applications of Computers - Basic Organization of a Computer - Number system - Binary, Decimal, Octal and Hexadecimal - Problems

UNIT-II:-INTRODUCTION TO PROBLEM SOLVING AND PROGRAMMING 9 Hrs

General Problem - Solving Concepts - Problem Solving Concepts for the Computer - An Introduction to Programming Structure - Problem Solving with the Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops

UNIT- III:- DATA STRUCTURES 9 Hrs

Primary Data Types - One-dimensional Arrays - Two-dimensional Arrays - Table Look-Up Technique - Sequential Search, Binary Search - Sorting Techniques - Selection Sort, Bubble Sort, Shell Sort, Stacks, and Queues - File Concepts

UNIT- IV:- PROGRAMMING STRUCTURE OF C LANGUAGE 9 Hrs

Importance of C - Basic Structure of a C Program – Constants, variables and data types- Operators and Expressions - Input and Output Operations - Branching and Looping - Arrays and Strings - User-defined Functions

UNIT –V:- PROGRAMMING IN C LANGUAGE 9 Hrs

Structures and Unions – Pointers - File Management in C - Development of C programs - Executing a C Program - compilation and linking - Common Programming Errors - Program Testing - Program Debugging

Total : 45 Hours

TEXT BOOKS:

1. Maureen Sprankle & Jim Hubbard, “Problem Solving & Programming Concepts”, Sixth Edition, Prentice Hall, 2012.
2. E. Balagurusamy, “Programming in ANSI C”, Seventh Edition, McGraw Hill India, 2016.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

REFERENCES:

1. Ashok Kamthane, “Programming in C”, Third Edition, Pearson Education India, 2015.
2. Herbert Schildt, “C: The Complete Reference”, Fourth edition, McGraw Hill Education, 2000.
3. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGrawHill, 2006.
4. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name	**L**	**T**	**P**	**C**
UBBTC01	Environmental Studies	2	0	0	2

Year and Semester	I Year & I Semester		Contact Hours Per Week	
Prerequisite course	Nil		2 Hrs	
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
		√		
Course Objectives	1. To study the interrelationship between living organism and environment. 2. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.			
Course Outcomes	After successful completion of Course, the students will be able to 1. Implement scientific, technological, economic and political solutions to environmental problems. 2. Identify the interrelationship between living organism and environment. 3. Understand the importance of environment by assessing its impact on the human world 4. Analyze the vision the surrounding environment, its functions and its value. 5. Discuss the development and improvement in std. of living. 6. Classify the integrated themes such as biodiversity, natural resources, pollution control and waste management.			

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	3	2	-	1	-	-	-	-	-	-	2	-	-	-
CO4	2	2	-	2	2	-	-	-	-	-	-	2	3	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	3	-	-	-
CO6	3	3	2	2	3	-	-	-	-	-	-	2	2	-	-
AVERAGE	**2.7**	**2**	**2**	**2**	**1.8**	-	-	-	-	-	-	**2.3**	2.3	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I: **6Hrs**

Environmental studies – terminologies – need for public awareness – Natural resources – Renewable and non – renewable resources – Characteristics, uses and conservation of natural resources-Forest resources, Water resources, Mineral resources, Food resources, Energy resources and Land resources – Role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

UNIT II: **6Hrs**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the different ecosystems – Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III: **6Hrs**

Introduction – Definition : genetic, species and ecosystem diversity – Biogeographical classification of India –Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – Inida as a mega-diversity nation Hot-sports of

biodiversity– Threats to biodiversity - Endangered and endemic species of India – Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity**.**

UNIT IV: **6Hrs**

Environmental Pollution – Cause, effects and control measures of different types of pollution-Solid waste Management –Role of an individual in prevention of pollution – Disaster management. Social Issues and the Environment – from Unsustainable to Sustainable development – Urban problems related to energy – Water conservation – Resettlement and rehabilitation of people – its problems and concerns- Environmental ethics – Climate change, global warming, nuclear hazards, ill-effects of fireworks – Wasteland reclamation – Laws and acts in India for environment protection , Public awareness.

UNIT V: **6Hrs**

Population growth-variation among nations-Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare– Role of Information Technology in Environment and human health. Field work and Field Visit.

TOTAL : 30 Hours

TEXT BOOK:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006.

REFERENE BOOKS:

1. Agarwal K.C. Environmental Biology, Nidi Publications Limited, Bikaner, India, 2001.
2. Erach Bharucha. Textbook of Environmental Studies for Undergraduate Courses. University Grants Commission, New Delhi , 2013.
3. N. Arumugam and V Kumaresan, Environmental Studies (UGC Syllabus), Saras Publications, Nagercoil, India, 2014.
4. D.K. Asthana and Meera Asthana, A Textbook of Environmental Studies. S. Chand Publishing, New Delhi, 2010.
5. B.S. Chauhan, Environmental Studies. Laxmi Publications, New Delhi, 2015

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UBCHCPA	Course Name Engineering Chemistry Laboratory		**L** 0	**T** 0	**P** 2	**C** 1
Year and Semester	I Year & I Semester		Contact Hours Per Week 2 Hrs			
Prerequisite course	Nil					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
	√					

Course Objectives

1. To make the student to develop practical skills in the determination of water quality parameters through volumetric analysis.
2. To enlighten the student on instrumental methods for estimation of pH, conductivity, metal ion content, determination of molecular weight and degree of dissociation of a polymer by viscometry.

Course Outcomes

After successful completion of Course, the students will be able to

1. Illustrate how to estimate Bicarbonate and Hydroxide Alkalinity
2. Explain how to calculate Total Hardness and Chloride Content of water
3. Demonstrate how to estimate Temporary and Permanent Hardness, COD, BOD,TDS and TSS of water
4. Compare the titration methods of acid, base and Ferrous ion
5. Determine Single Electrode potential of Galvanic cell and Molecular weight and degree of dissociation of a polymer
6. Explain how to determine Proximate analysis of fuel and its Calorific value

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	3	3	-	2	-	2	3	-	2	1	-	-
CO2	2	2	-	2	3	-	3	-	3	2	-	-	1	-	-
CO3	2	1	-	3	2	-	3	-	2	3	-	-	1	-	-
CO4	2	1	-	3	3	-	3	-	3	2	-	-	1	-	-
CO5	3	2	-	3	2	-	-	-	2	3	-	-	1	-	-
CO6	3	2	3	2	2	-	3	-	3	2	-	-	1	-	-
AVERAGE	2.33	1.67	3	2.67	2.5	-	2.8	-	2.5	2.5	-	2	1	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

List of Experiments:

1. Estimation of Bicarbonate Alkalinity
2. Estimation of Hydroxide Alkalinity
3. Estimation of Total Hardness of Water
4. Estimation of Chloride Content of Water
5. Estimation of Temporary and Permanent Hardness
6. Estimation of COD & BOD of Water, TDS and TSS (Demo only)

7. Conduct metric Titration of a strong acid and base.
8. PH titration of a strong acid and strong base
9. Potentiometric titration of Ferrous Ion
10. Determination of Single Electrode potential (Galvanic Cell)
11. Determination of Calorific value of a solid fuel
12. Determination of Molecular weight of a polymer.
13. Determination of degree of dissociation of a polymer.
14. Proximate analysis of a solid fuel / Liquid fuel

TOTAL : 30 Hours

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCLECPB	Course Name: Spoken English-I		**L** 0	**T** 0	**P** 4	**C** 2
Year / Semester	I Year & I Semester		Contact hours per week			
Prerequisite course	Nil		4 Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	√					
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
Course Objective	1. To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions, seek clarifications. 2. To help learners develop their speaking skills and speak fluently in real contexts. Making them realize the importance of English as Global language and its importance in today's scenario.					
Course Outcome	After the successful completion of the course, the students will be able to: 1. Develop skills in informal conversation; comprehend their views without making grammatical errors 2. Define their perspective more operationally 3. Infer the delicacy of using the linguistics skills 4. Develop listening and speaking skills for effective presentation 5. Develop good attitude and behavior 6. Build interview skills and personality development					

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	1	2	2	3	-	2	-	-	-
CO3	-	-	-	-	-	2	1	2	2	2	-	3	-	-	-
CO4	-	-	-	-	-	2	2	2	2	1	-	3	-	-	-
CO5	-	-	-	-	-	3	2	2	3	2	-	1	-	-	-
CO6	-	-	-	-	-	3	1	2	1	2	-	2	-	-	-
AVERAGE	-	-	-	-	-	2.33	1.50	2.00	2.00	2.00	-	2.17	-	-	-
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT 1: GRAMMAR AND FOUNDATON **18 Hrs**

Training the students on basic grammar and foundation and laying the standard platform-A complete standard syllabus of Cambridge is used-The main part of the 1st semester is to cover the major tenses (Present tense, Present Continuous, Past Tense, Past Continuous, Present Perfect, and Present Perfect continuous).

UNIT II: FOCUS ON LANGUAGE – VOCABULARY **4 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases- Diplomatic Phrases – Food Phrases- Vocabulary-Words commonly misspelt – Lab-Test.

UNIT III: INTERACTIVE ENGLISH **10 Hrs**

The main objective is English for International communication-It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design- The course covers the fours skills of listening, speaking, reading and writing, as well as improving pronunciation and building vocabulary.

UNIT IV: LISTENING AND SPEAKING **14 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique-Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation-Debate , Oratorical Lab

UNIT V: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT **14 Hrs**

Out of box thinking -Lateral Thinking- Intrinsic and Extrinsic Motivators- Factors influencing Attitude-Challenges and lessons from Attitude- Etiquette-Value of time- Diagnosing Time Management- Weekly Planner To do list- Prioritizing work.

TOTAL : 60 Hours

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UCITCPA	Programming in C and C++ Lab	**L**	**T**	**P**	**C**
		0	0	2	1
Year / Semester	I Year & I Semester	Contact hours per week			
Prerequisite course	Nil	2 Hrs			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
		√			
Course Objective	1. To compile and execute programs in C 2. To identify the syntax errors and semantic errors 3. To debug the program in C				
Course Outcome	After the successful completion of the course, the students will be able to: 1. Develop logics to swap two numbers, finding largest of given numbers and roots of quadratic equation 2. Develop logic to print Fibonacci Series and sum of odd numbers and to find the area and Perimeter of the Circle, Triangle, and Square 3. Determine maximum, minimum, Sum and average of elements of an array 4. Determine the sum and multiplication of two matrices 5. Determine whether a string is palindrome or not and find number of vowels and of consonants in a given string 6. Develop logic to perform the operations using function and pointer				

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1		-	-	-	-	2	-	1	-	-	-
CO2	3	2	3	2	-	-	-	-	-	2	-	2	-	-	-
CO3	3	2	3	2	2	-	-	-	-	1	-	2	-	-	-
CO4	2	2	2	1	2	-	-	-	-	1	-	2	-	-	-
CO5	2	2	2	2	2	-	-	-	-	2	-	2	-	-	-
CO6	2	3	3	2	3	-	-	-	-	2	-	2	-	-	-
AVERAGE	2.33	2.17	2.50	1.67	2.25	-	-	-	-	1.67	-	1.83	-	-	-
CORRELATION LEVELS				4. SLIGHT (LOW)				5. MODERATE (MEDIUM)				6. SUBSTANTIAL (HIGH)			

LIST OF EXPERIMENTS

1. Program to write in ascending and descending order of a given ‘n’ numbers using C
2. Program to find the odd, even, maximum, minimum, sum and average of given ‘n’ numbers using C
3. Program to swap two numbers without using third variable using C
4. Program to solve quadratic equation using C
5. Program to find the Fibonacci sequence using C
6. Program to find the Addition of two matrixes using C
7. Program to identify the palindrome string
8. Program to use File operations – create, open, read, write, close and search
9. Program to apply sequential and binary search in C
10. Program to apply Selection Sort, Bubble Sort, Shell Sort algorithms
11. Write functions for Stack operations – create a stack, add & remove an item
12. Write functions for Queue operations – create a queue, add & remove an item

TOTAL : 30 Hours

SEMESTER-II

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UCLEC02</td><td colspan="2">Course Name:

Technical English-II</td><td>L

2</td><td>T

0</td><td>P

0</td><td>C

2</td></tr>
<tr><td>Year / Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

2 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td>√</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To make the students learn to speak grammatically correct English. Guiding and supporting their skill development –Listening, speaking, reading and writing in English..

2. Making them realize the importance of English as Global language and its importance in today’s scenario.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Identify the importance of technical English
2. Apply good communication skill for enhancing vocabulary
3. Develop skills in reading
4. Build knowledge on writing letters and descriptive writings
5. Develop speaking and listening skills
6. Apply the correct pause and pronunciation</td></tr>
</table>

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO2	-	-	-	-	-	3	2	-	2	2	-	2	-	-	-
CO3	-	-	-	-	-	2	1	-	2	2	-	2	-	-	-

CO4	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO5	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
CO6	-	-	-	-	-	1	3	-	2	2	-	2	-	-	-
AVERAGE	-	-	-	-	-	2.00	2.00	-	2.00	2.00	-	2.00	-	-	-
CORRELATION LEVELS				**1. SLIGHT (LOW)**				**2. MODERATE (MEDIUM)**				**3. SUBSTANTIAL (HIGH)**			

UNIT I: COMMUNICATION & FOCUS ON LANGUAGE **6 Hrs**

Process of Communication -Language as a tool of Communication-Importance of Technical Communication.

UNIT II: VOCABULARY & ENGLISH GRAMMAR **6 Hrs**

General Vocabulary-Dictionary-Word Formation: Prefix and Suffix-Synonyms and antonyms- Idioms and Phrases-Homophones -Parts of Speech-Subject Verb Agreement-Tenses, Articles, Prepositions-Common errors in English General Vocabulary - Adverbs- Gerund and Infinitive – Word Formation: Prefix and Suffix - Noun - Compound Noun-Adjective – Degrees of Comparison – Double Adjective - Voice -Tense – Verbs - Homograph, Homophone – Commonly Confused Words - Collocation – Punctuation marks.

UNIT III: READING SKILL **6 Hrs**

Intensive Reading-Skimming &Scanning - Extensive Reading –Meta cognitive reading - Topic sentence and its Role-Reading and Interpretations- Critical Reading – Reading and summarizing.

UNIT IV: WRITING SKILL **6 Hrs**

Descriptive Writing –Paragraph-Technical descriptions-Essays-Letter Writing – Formal and Informal-Business Letters-Job Application Letter-Types of reports-Instructions and Checklists Paragraph Writing- Descriptive Writing –Paragraph - Definition Writing – Extended Definition – Purpose Statement – Sequence words – E mail writing – Flow chart – pie chart – note taking – Dialogue writing – Circular writing- Latter to the editor – personal letter writing – circular writing

UNIT V: LISTENING AND SPEAKING **6 Hrs**

Types of Listening -Listening and note taking-Pronunciations-Stress and Intonation- Conversation technique- Dialogue Writing -Professional Communication-Interview-Group Discussion –Power point Presentation-Lab Listening and note taking – Role play – Group Discussion

TOTAL: 30 Hours

TEXT BOOK:

1.Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.

2.English and communication skills—S.P.Dhanavel.Orient Blackswan (2010).

REFERENCE BOOKS:

1.Essential Grammar use – Raymond Murphy, Cambridge (2007).

2.Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008.

3.Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.

4.Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBMTC02</td><td colspan="2">Course Name:

Engineering Mathematics – II</td><td>L

3</td><td>T

1</td><td>P

0</td><td>C

4</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

4 Hours</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td>√</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To provide the required skill to apply the concepts of ordinary differential equations.
2. To provide the required ideas to solve the problems on higher order ordinary differential equations.
3. To acquaint the student with the concepts of vector calculus needed for problems in engineering discipline.
4. To understand the standard techniques of complex variable problems.
5. To create new domains to handle the problem in easier by using transform.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:
1. Infer knowledge on ordinary differential first order equations
2. Illustrate the use of ordinary differential higher order equations
3. Solve problems using vector calculus
4. Demonstrate the properties of analytic functions
5. Demonstrate Laplace transforms in engineering applications
6. Apply differential equations, vector calculus and Laplace transforms in engineering applications</td></tr>
</table>

PPOs / COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**

CO1	3	2	3	2	2	-	-	-	-	-	-	3	2	2	2
CO2	3	2	3	2	3	-	-	-	-	-	-	3	2	2	2
CO3	2	3	2	2	2	-	-	-	-	-	-	3	2	2	2
CO4	3	2	3	2	2	-	-	-	-	-	-	3	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	2	2	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	2	2
AVERAGE	2.83	2.5	2.83	2.33	2.5	-	-	-	-	-	-	3	2.33	2.5	2.5

CORRELATION LEVELS	**1. SLIGHT (LOW)**	**2. MODERATE (MEDIUM)**	**3. SUBSTANTIAL (HIGH)**

UNIT I ORDINARY DIFFERENTIAL EQUATIONS–FIRST ORDER AND APPLICATION 12Hrs

Definition - order and degree - formation of differential equation - Solution of first order - first degree equations in variable separable form - homogeneous equations - other substitutions - Equations reducible to homogeneous and exact differential equations - Equations reducible to exact Integration Factor - Linear differential equation of first order first degree, reducible to linear - Applications to electrical circuits and orthogonal trajectories.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS–HIGHER ORDER AND APPLICATIONS12 Hrs

Higher (nth) order linear differential equations - definition and complementary solution- Methods of obtaining PI, Method of variation of parameters - Method of undetermined coefficients - Cauchy‘s Homogeneous LDE and Legendre‘s equations - System of Ordinary Differential Equations Simultaneous equations in symmetrical form.

UNIT III VECTOR CALCULUS 12 Hrs

Gradient Divergence and Curl – Directional derivative – irrotational and solenoidal vector fields –Vector integration – Green‘s theorem in a plane, Gauss divergence theorem and stokes‘theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT IV ANALYTIC FUNCTIONS 12 Hrs

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping - bilinear transformation.

UNIT V LAPLACE TRANSFORM 12 Hrs

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties– Transform of derivatives and integrals – Transform of unit step function and impulse functions –Transform of periodic functions. Definition of Inverse Laplace transforms as contour integral – Convolution theorem (excluding proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60

Hours

TEXT BOOK:

1.Bali N. P and Manish Goyal, ―Text book of Engineering Mathematics, 3rd Edition, Laxmi Publications (p) Ltd., 2008.

2.Grewal. B.S, ―Higher Engineering Mathematics, 40thEdition, Khanna Publications, Delhi, 2007.

REFERENCE BOOKS:

1.Ramana B.V, ―Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, NewDelhi, 2007.

2.Glyn James, ―Advanced Engineering Mathematics, 3rdEdition, Pearson Education, 2007.

3.Erwin Kreyszig, ―Advanced Engineering Mathematics, 7thEdition, Wiley India, 2007.

4.Jain R.K and Iyengar S.R.K, ―Advanced Engineering Mathematics, 3rdEdition, Narosa Publishing House Pvt., 2007.

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UCPHCO2</td><td>Course Name

Engineering Physics - II</td><td>L

3</td><td>T

0</td><td>P

0</td><td>C

3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

3 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td>Professional Elective</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td>Mandatory</td></tr>
<tr><td></td><td>√</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Course Objectives</td><td colspan="5">Students should understand about properties of light and sound waves and relate their significance for the development of technology</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">After the successful completion of the course, the students will be able to:

1. Demonstrate the applications of sound waves

2. Explain the principles of laser and its applications

3. Illustrate miller indices and X-Ray power defraction method to identify crystal structure

4. Compare the electrical conductivity in semiconductors and superconductors

5. Contrast dielectric and magnetic materials

6. Infer the principles of light and sound waves in various applications</td></tr>
</table>

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	3	2	2	-	-	-	-	-	-	2	2	2	2
CO2	2	1	2	3	2	-	-	-	-	-	-	2	2	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	2	2	2	2
CO4	2	3	3	1	2	-	-	-	-	-	-	2	2	2	2
CO5	3	3	2	3	3	-	-	-	-	-	-	2	2	2	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	2	2
AVERAGE	2.67	2.33	2.33	2.33	2.33	-	-	-	-	-	-	2.17	2	2	2

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT – I: ACOUSTICS AND ULTRASONICS: **9 Hrs**

Wave-types of waves-wave motion. Sound- classification of sound – characteristics of musical sound. Loudness – Weber Fechner law – Decibel – Reverberation – Reverberation time – Sound absorption coefficient- Sabine's formula for determining reverberation time (Rate of Growth and Rate of Decay) – determination of sound absorption coefficient – Factors affecting acoustics of buildings (Optimum reverberation time, loudness, focusing, eco, echelon effect, resonance and noise) and their remedies. Ultrasonics- production- piezo-electric method – SONAR-Ultrasonic flaw detector as non-destructive testing technique.

UNIT-II: LASER AND FIBRE OPTICS **9 Hrs**

Laser-principle-properties – Einstein coefficient (A and B)-Nd-YAG laser – CO_2 laser. Applications of laser – Holography-construction and reconstruction of a hologram – Principle and propagation of light in an optical fibre-types of optical fibres – applications-fibre optic communication system (block diagram) – fibre optic sensors.

UNIT-III: CRYSTAL PHYSICS **9 Hrs**

Lattice-unit cell – Bravais lattice – lattice planes – Miller indices – 'd' spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius-coordination number – packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) – X-ray - Powder diffraction method to identify crystal structure parameters.

UNIT-IV: SEMICONDUCTORS AND SUPERCONDUCTORS **9 Hrs**

Semiconductors – intrinsic and extrinsic semiconductor. Fermi level –Variation of Fermi level with temperature-electrical conductivity. Band gap determination-Hall effect – Determination of Hall coefficient – Applications. Superconductivity: Properties – Type I and Type II superconductors – BCS theory of superconductivity-High Tc superconductors-Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT-V: DIELECTRIC, MAGNETIC AND NEW ENGINEERING MATERIALS **9 Hrs**

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarizations-frequency and temperature dependence on polarization-internal field – Claussius-Mosotti relation – uses of dielectric materials. Magnetic properties – diamagnetic – paramagnetic – ferromagnetic materials – super paramagnetism – Transducers. Properties and applications of metallic glasses – nano materials – shape memory alloys – bio materials.

TOTAL: 45 Hours

TEXT BOOKS

1. S. O Pillai "Solid State Physics", New Age International Pvt Ltd; 7th edition, 2015.

2. Ajoy Ghatak , "Optics", McGraw-Hill Education; 1st edition 2009.

3. Ajoy Ghatak, "Introduction to Fiber optics", Foundation Books, 2002.

REFERENCES BOOKS:

1. Charles Kittel," Introduction to Solid state physics", Wiley; Eighth edition 2012.

2. Ghatak and Thyagarajan, "Laser Fundamentals and Applications", Springer, 2011.

3. Richard Feynmann, Robert Leighton and Matthew Sands,"The Feynmann Lectures on Physics",

Volume 1, Student Edition, Narosa Publishing house, 2003.

4. Richard Feynmann, Robert Leighton and Matthew Sands "The Feynmann Lectures" on Physics,

Volume 2, Student Edition, Narosa Publishing house, 2003.

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBEEC01</td><td colspan="2">Course Name:

Basics of Electrical and Electronics Engineering</td><td>L

3</td><td>T

0</td><td>P

0</td><td>C

3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

3 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td>√</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To familiarize the basic laws, DC and AC theorems and the methods of analyzing electrical circuits.

2. To understand the characteristics and performance of Semiconductor devices, Moving coil and moving iron instruments.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Outline KCL, KVL and related methods to solve DC circuits

2. Illustrate the operation of single phase AC Circuits

3. Explain the principle of operation of three phase AC Circuits

4. Infer the performance characteristics of Semiconductor Devices

5. Demonstrate the working principle of Electrical instruments</td></tr>
</table>

	6. Apply the knowledge of electric circuits and electronic devices for engineering applications

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	3	2	-	-	-	-	-	-	-	3	3	2	3
CO2	2	3	2	2	-	-	-	-	-	-	-	2	2	2	3
CO3	2	3	3	2	-	-	-	-	-	-	-	2	2	2	3
CO4	3	3	2	2	-	-	-	-	-	-	-	3	3	3	3
CO5	3	2	2	3	-	-	-	-	-	-	-	2	2	2	3
CO6	3	3	3	2	-	-	-	-	-	-	-	3	3	2	3
AVERAGE	2.67	2.67	2.50	2.17	-	-	-	-	-	-	-	2.50	2.50	2.17	3.00

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT I:DC CIRCUITS **9 Hrs**

Importance of Electrical Engineering in day-to-day life - Electrical elements and their classifications - KCL and KVL equations - Loop current and node voltage method - Steady state analysis with independent and dependent sources - parallel and series circuits and star delta conversion.

UNIT II: ANALYSING SINGLE PHASE AC CIRCUITS **9 Hrs**

Common Signals and their Wave Form: RMS Value, Average Value, Form Factor and Peak Factor - Single Phase A.C Series Circuits: Types, Phasor Diagram, Power Factor, Impedance, Power Triangle - Single Phase

A.C Parallel Circuits: Types, Phasor Diagram, Power Factor, Power Triangle – A.C Network Theorem's: Thevinin's and Norton's Theorem– Superposition Theorem – Maximum Power Transfer Theorem - Mesh Current and Node Voltage Method with A.C sources.

UNIT III: ANALYSING THREE PHASE AC CIRCUITS **9 Hrs**

Three Phase Balanced and Unbalanced Voltage Sources – Analysis of Three Phase 3-Wire and 4-Wire Circuits with Star and Delta Connected Loads, Balanced & Unbalanced – Phasor Diagram of Voltages and Currents – Power and Power Factor Measurements in Three Phase Circuits.

UNIT IV: SEMICONDUCTOR DEVICES **9 Hrs**

Characteristics of PN Junction Diode-Zener effect-Zener Diode and its Characteristics- Voltage regulation- Bipolar Junction Transistor-CB, CE ,CC Configurations and Characteristics- Basic Construction of 'N' channel & 'P' channel JFET-Half wave and Full wave rectifiers.

UNIT V: BASIC ELECTRICAL MEASUREMENTS **9 Hrs**

Construction and Operating Principles of Moving Coil and Moving Iron Instruments (Ammeter and Voltmeter), Dynamometer Type Wattmeter and Basic Torque Equations, Electro-dynamic frequency meter, Energy Meter and Megger – Measurement Errors.

TOTAL: 45 Hours

TEXT BOOKS:

1. Arumugam and Prem Kumar, Electric Circuit Theory, Khanna Publishers, 2002.
2. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003
3. R.S.Sedha, A Textbook of Applied Electronics, 3rd revised edition Edition,2008.
4. A.K.Sawhney-A Course in Electrical and Electronics Measurements and Instrumentation, 19th Revised Edition 2011.

REFERENCE BOOKS:

1. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill, 2007.
3. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBMCC03</td><td colspan="2">Course Name:

Engineering Mechanics</td><td>L

3</td><td>T

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4 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
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<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td>√</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. Develop the ability to understand, formulate and analyze any engineering problem in a simple logical manner and to solve basic problems in Engineering Mechanics.

2. Further, he should understand the principle of work and energy</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Explain the engineering principles dealing with force, displacement, velocity and acceleration

2. Build the knowledge on the equilibrium of rigid bodies

3. Determine Friction and its effects</td></tr>
</table>

	4. Explain the fundamental concepts of kinematics and kinetics of particles to solve engineering problems 5. Demonstrate the principles of work and energy of particles Apply the concept of mechanics for engineering applications 6. Apply the concept of mechanics for engineering applications

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	2	-	-	-	-	-	-	-	2	2	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	3	2
CO4	3	2	3	2	2	-	-	-	-	-	-	2	2	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	2	2
CO6	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
AVERAGE	3.00	2.50	2.50	2.00	2.00	-	-	-	-	-	-	2.17	2.17	2.33	2.33
CORRELATION LEVELS				**1. SLIGHT (LOW)**				**2. MODERATE (MEDIUM)**				**3. SUBSTANTIAL (HIGH)**			

UNIT I BASICS & STATICS OF PARTICLES **12 Hrs**

Introduction - Units and Dimensions – Forces – System of forces – Resultant forces – Parallelogram law of forces – Triangular law of forces – Polygon law of forces – Resolution and composition of forces – Principles of transmissibility. Single equivalent force - Equilibrium of particles – Moment and couple – Scalar components of moment – Varigon‘s Theorem.

UNIT II EQUILIBRIUM OF RIGID BODIES **12 Hrs**

Equilibrium of forces – Law of mechanics - Lami‘s theorem. - Free body diagram – Requirement of Stable Equilibrium – Equilibrium of rigid bodies in 2D – Examples - Type of supports and their support reactions.

UNIT III FRICTION **12 Hrs**

Static and Dynamic Friction – Laws of friction - Equilibrium of a body on a rough Horizontal plane, inclined Plane and inclined plane subjected to a force acting along the inclined plane - Applications of friction – Simple contact friction (Ladder friction) – Screw friction – weight lifted by screw jack - Belt friction – Rolling Resistance.

UNIT IV PROPERTIES OF SURFACES AND SOLIDS **12 Hrs**

Determination of Areas and Volumes-First moments of area and the Centroid of sections- Rectangle, circle, triangle from integration-T section, I section, Angle section, Hollow section using standard formula- Second and product moments of plane area- Rectangle, triangle, circle from integration-T section. I section, Angle section, Hollow section by using standard formula parallel axis theorem and perpendicular axis theorem- Mass moment of Inertia.

UNIT V DYNAMICS OF PARTICLES AND RIGID BODIES **12 Hrs**

Dynamics of Particles - Displacement, velocity and acceleration, their relationship – Relative motion- Curvilinear motion – Newton‘s law – work-energy equation of particles - Impulse and Momentum – Law of conservation of momentum – D‘Alembert‘s Principle – Types of collision - Collision of Elastic Bodies – Newton‘s law of collision of bodies - co-efficient of restitution. Dynamics of Rigid Bodies – General plane motion – Velocity and Acceleration – Absolute and relative motion method – Equilibrium of Rigid bodies in Plane motion.

TOTAL : 60 Hours

TEXT BOOKS:

1. K.V. Natarajan, “Engineering Mechanics”, Dhanalakshmi publications, Revised Edition, 2008.

2. R.S Khurmi, ―A Textbook of Engineering Mechanics, S. Chand Publishers, 20th Revised Edition, 2014.

REFERENCE BOOKS:

1. S.S. Bhavikatti, ―Engineering Mechanics, New Age International Publishers, 4th revised edition, 2012.

2. Palanichamy & Nagan, ―Engineering Mechanics Statics & Dynamics, Tata McGraw-Hill, Latest Edition, 2001.

3. S. Rajasekaran, G. Sankara Subramanian, “Fundamentals of Engineering Mechanics”, Vikas Publishing House Pvt. Ltd., 2006.

4. Beer, F.P and Johnson Jr. E.R, ―Vector Mechanics for Engineers, Vol.1 Statics and Vol.2. Dynamics, Tata McGraw-Hill International Edition, 2001.

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code</td><td>Course Name</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>UBMCC11</td><td>Thermodynamics</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact Hours Per Week
3Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td>Professional Elective</td></tr>
<tr><td></td><td></td><td colspan="2">√</td><td></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td>Mandatory</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. This course provides basic knowledge about thermodynamics and relation and their application to various processes.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">The Students will be able to
1. Understand thermodynamics laws and their application
2. To understand concept of entropy and availability
3. Know about the properties of steam and their uses of steam table and mouier chart
4. Understand thermodynamics relation
5. Understand about psychometric chart
6. Understand about gas mixture</td></tr>
</table>

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	-	-	-	2	-	-	-	2	2	-
CO2	2	2	3	2	-	-	-	-	1	2	-	2	3	1	2
CO3	2	2	2	2	1	-	-	-	2	2	2	2	2	2	2
CO4	2	2	2	2	1	-	-	-	1	2	-	1	3	1	2
CO5	2	2	2	2	2	-	-	-	3	1	3	3	3	2	2
CO6	2	2	3	2	3	-	-	-	2	3	3	3	3	1	2
AVERAGE	2	2	2.3	1.8	1.8	-	-	-	1.8	2	2.7	2.2	2.7	1.5	1.7

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT – I : BASIC CONCEPTS AND FIRST LAW **9 Hrs**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic Approach.Path and point functions. - Intensive and extensive, total and specific quantities. - System and their types.Thermodynamic Equilibrium State, path and process -Quasi-static, reversible and irreversibleprocesses. - Heat and work transfer, definition and comparison, sign convention - Displacement work and other modes of work - pv diagram.Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales.First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes

UNIT II:**SECOND LAW AND AVAILABILITY ANALYSIS** **9 Hrs**

Heat Reservoir, source and sink.-Heat Engine, Refrigerator, Heat pump. -Statements of second law and its corollaries. -Carnot cycle Reversed Carnot cycle, Performance. -Clausius inequality. - Concept of entropy, t-s diagram, Tds Equations, entropy change for - pure substance, ideal gases – different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III :PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE **9 Hrs**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface.Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances.Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economizer, preheater, Binary and Combined cycles.

UNIT IV :**IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS** **9 Hrs**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases-Reducedproperties-Compressibility factor-.Principle of Corresponding states.Generalized Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat

capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V: GAS MIXTURE AND PSYCHROMETRY **9 Hrs**

Mole and Mass fraction, Dalton‘s and Amagat‘s Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function.Psychometric properties, Psychometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 45 Hours

TEXT BOOKS:

1. Nag.P.K., ―Engineering Thermodynamics‖, 4thEdition, Tata McGraw-Hill, New Delhi, 2008.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, TataMcGraw Hill, 2010

REFERENCE BOOKS:

1. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", AnuragamPublications, 2012
2. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd
4. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010
5. Arora C.P, ―Thermodynamics‖, Tata McGraw-Hill, New Delhi, 2003

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBEECPA</td><td colspan="2">Course Name:

Basics of Electrical and Electronics Engineering Laboratory</td><td>L

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<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

2 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
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<tr><td></td><td></td><td>√</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. To acquire knowledge with an adequate work experience in the measurement of different quantities.

2. Expertise in handling the instruments involved.</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Demonstrate instruments such as ammeter and voltmeter for measuring resistance, power and power factor

2. Compare the vector diagrams of series and parallel R,L and C circuits

3. Explain how to measure power input to three phase induction motor using watt meters

4. Illustrate the characteristics of PN diode, Zener diode and JFET</td></tr>
</table>

	5. Contrast the working principle of half wave and full wave rectifier using CRO 6. Combine measuring instruments for different parameters in engineering applications

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	3	3	2	1	-	-	-	2	2		3	3	3	2
CO2	2	3	3	2	1	-	-	-	2	2		2	3	3	2
CO3	2	3	3	2	1	-	-	-	2	2		2	3	3	2
CO4	2	3	3	2	1	-	-	-	2	2		2	3	3	2
CO5	2	3	3	2	1	-	-	-	3	3		3	3	3	2
CO6	2	3	3	2	1	-	-	-	3	3		3	3	3	3
AVERAGE	2	3	3	2	1	-	-	-	2.33	2.33	-	2.5	3	3	2.17

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

List of Experiments

1. Measurement of 'Low and High' resistances by Voltmeter and Ammeter method.

2. Obtain the current and voltage distribution in A.C. 'R-L-C' series circuits and draw the vector diagrams.

3. Obtain the current and voltage distribution in AC ‘R.L.C’ parallel circuits and draws the vector diagrams.

4. Measure the power and power factor of a single-phase load by 3 voltmeter method & ammeter method.

5. Measure the power input to 3-phase induction motor using two watt meters.

6. Characteristics of PN Junction Diode.

7. Characteristics of Zener Diode

8. Characteristics of JFET

9. Study of Half wave and Full wave Rectifiers

10.Study of CRO and LISSAJOUS patter

TOTAL: 30 Hours

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UBWSCPA</td><td colspan="2">Course Name:

Engineering Practices Laboratory</td><td>L

0</td><td>T

0</td><td>P

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2</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

4 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
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<tr><td></td><td></td><td>√</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">To provide exposure to the students with hands on experience on machining, electric arc welding oxy – acetylene welding and fitting</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Outline the operation of lathes and drilling machines.

2. Construct the structures using welding equipments

3. Create simple components using lathe and drilling machine

4. Develop the Process of chipping, filling, hack sawing, drilling and tapping

5. Plan assembling and dismantling of components

6. Construct simple lap, butt and tee joints using arc welding equipments</td></tr>
</table>

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	2	-	2	-	-	-	2	2	-	-	-	-	-
CO2	2	-	2	-	2	-	-	-	2	2	-	-	-	-	-
CO3	2	-	2	-	2	-	-	-	2	2	-	-	-	-	-
CO4	2	-	2	-	2	-	-	-	2	2	-	-	-	-	-
CO5	2	-	2	-	2	-	-	-	2	2	-	2	-	-	-
CO6	2	-	2	-	2	-	-	-	2	2	-	2	-	-	-
AVERAGE	2.00	-	2.00	-	2.00	-	-	-	2.00	2.00	-	2.00	-	-	-

CORRELATION LEVELS	4. SLIGHT (LOW)	5. MODERATE (MEDIUM)	6. SUBSTANTIAL (HIGH)

MACHINING:

Introduction and familiarization of operation of laths, drilling machines, shaping, milling and grinding machines - Safety- personal, tools, machines and environmental - Measuring tools and methods of measurement, reading of sketches and drawing, cutting tools, tool geometry - setting of tools methods of fixing of jobs on chucks, vices, jigs and fixtures - Speeds and feeds of machines - Operations of machines - Practical exercises on machines to develop and improve hands on skills.

FITTING:

Introduction and familiarization of various hand tools- Measuring, marking, cutting, holding and assembly tools, materials, parts, uses and safety of tools and personal safety - Process and procedures for measuring, Understanding of sketches and drawing - Marking and job holding methods - Process of chipping, filling, hack sawing, drilling, tapping, dieying, assembling and dismantling of components - Practical exercises to develop and improve hands on skills.

ELECRIC ARC WELDING

Introduction, familiarization of different types of welding machines- welding Transformer, functions, tools, and equipment and environmental - Basic procedures of striking the arc - different methods of joining metals- different welding joints in different positions - welding defects - testing of welding joints - Practical exercises of welding of different thickness of metals in different positions to develop and improve hands on skills.

OXY – ACETELENE WELDING

Introduction – familiarization of tools and equipments - Gas cylinders, regulators, hoses and gas welding and gas cutting blow pipes - DS Processors - Procedures for setting up the equipments - Checking for leakage of gases, setting of jobs filler rods, flux, flame setting and controls of flame safety - personal safety protection, safety of cylinders, tool equipments and environmental safety-Procedures for gas welding, brazing and gas cutting - Different methods of joints in different positions and defects of joints, testing of joints - Practical exercises to develop and improve hands on skill of gas welding, brazing and gas cutting.

TOTAL : 60 Hours

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UCPHCPB</td><td colspan="2">Course Name:

Engineering Physics Lab</td><td>L

0</td><td>T

0</td><td>P

2</td><td>C

1</td></tr>
<tr><td>Year / Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

2 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Nil</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td>√</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Course Objective</td><td colspan="6">Students should obtain the skill to design experiments to demonstrate various

concepts of physics for determination of properties of materials</td></tr>
<tr><td>Course Outcome</td><td colspan="6">After the successful completion of the course, the students will be able to:

1. Explain the calibration of Voltmeter and Potentiometer

2. Demonstrate the principles of light through convex lens and calculating its wavelength

3. Determine the surface tension and co-efficient of viscosity of water

4. Infer modulus of elasticity of torsion pendulum and Young’s modulus of elasticity of a bar

5. Illustrate how to measure the thickness of the wire

6. Explain the concepts behind measurement of magnetic field along the axis of a coil</td></tr>
</table>

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	2	1	-	-	-	1	2	-	2	2	2	3
CO2	2	-	2	2	2	-	-	-	2	1	-	2	2	3	3
CO3	2	2	3	3	1	-	-	-	2	2	-	-	2	-	-
CO4	3	2	2	3	2	-	-	-	2	2	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	2	3	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	3	2	-	3	2	3	2
AVERAGE	2.50	2.20	2.33	2.50	2.00	-	-	-	2.00	2.00	-	2.20	2.00	2.60	2.40

CORRELATION LEVELS	7. SLIGHT (LOW)	8. MODERATE (MEDIUM)	9. SUBSTANTIAL (HIGH)

LIST OF EXPERIMENTS

1. Calibration of low range voltmeter - potentiometer
2. Torsion pendulum – Rigidity modulus of elasticity
3. Spectrometer- Grating - wavelength of mercury spectral lines
4. Newton`s rings – Radius of curvature of a convex lens
5. Air wedge – Thickness of a wire
6. Surface tension of water -Capillary rise method
7. Uniform bending – Young’s modulus of elasticity of a bar
8. Coefficient of viscosity of water – graduated burette
9. Non uniform bending -Young’s modulus of elasticity of a bar
10. Field along the axis of a coil

Total : 30 Hours

<table>
<tr><td>PROGRAM</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code

UCLECPC</td><td colspan="2">Course Name:

Spoken English-II</td><td>L

0</td><td>T

0</td><td>P

3</td><td>C

2</td></tr>
<tr><td>Year and Semester</td><td colspan="2">I Year & II Semester</td><td colspan="3" rowspan="2">Contact hours per week

3 Hrs</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">-</td></tr>
<tr><td rowspan="3">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td colspan="2">Professional Core</td><td>Professional Elective</td></tr>
<tr><td>√</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td colspan="2">Open Elective</td><td>Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>Course Objective</td><td colspan="5">1. To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions, seek clarifications.

2. To help learners develop their speaking skills and speak fluently in real contexts.

3. Address the interview confidently

4. Making them realize the importance of English as Global language and its importance in today‘s scenario.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">After the successful completion of the course, the students will be able to:

1. Apply Articles, Prepositions, Pronouns, Adjectives and Adverbs in their speaking and writing skills

2. Infer the knowledge on public speaking and conduct of meetings

3. Develop skills on interactive English

4. Develop listening and speaking skills for effective presentation</td></tr>
</table>

	5. Develop good attitude , behaviour and communication skills 6. Build interview skills and personality development

PPOs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	-	-	-	-	-	2	2	2	2	2	-	-	-	-	-
CO2	-	-	-	-	-	3	2	2	2	3	-	-	-	-	-
CO3	-	-	-	-	-	3	1	2	2	2	-	2	-	-	-
CO4	-	-	-	-	-	2	2	3	2	3	-	2	-	-	-
CO5	-	-	-	-	-	3	2	1	3	2	-	2	-	-	-
CO6	-	-	-	-	-	2	3	2	3	3	-	2	-	-	-
AVERAGE	-	-	-	-	-	2.50	2.00	2.00	2.33	2.50	-	2.00	-	-	-

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT 1: GRAMMAR AND FOUNDATON **9 Hrs**

Training the students on second phase of grammar such as Articles, Prepositions, Pronouns, Modal Auxiliaries, Parts of Speech, Adjectives and Adverbs .

UNIT II: INTRO TO PROFESSIONAL ETHICHS Hrs **9 hrs**

Stepping the students to advanced learning resource and introducing them about International standards How to conduct meetings, huddle, public speaking, free speech. Dress code.

UNIT III: INTERACTIVE ENGLISH **9 Hrs**

The main objective is English for International communication. It course contains conversations, snapshots, readings, activities, a greater variety and amount of listening materials and more visuals to introduce vocabulary, more opportunities to build fluency, and up-to-date art and design.

UNIT IV: LISTENING AND SPEAKING **9 Hrs**

Types of Listening –Introduction to International Standards of listening skills. Presentation skills: delivery (emphasis and phrasing) / making it interesting / body language / referring to visual aids

UNIT V: INTERVIEW SKILLS AND PERSONALITY DEVELOPMENT **9 Hrs**

Familiarize the students with types of Interviews such as mock interviews , campus Interview, Skype interview, telephonic Interview, Panel Interview,

TOTAL: 45 Hours

TEXT BOOKS:

1. Essential Grammar in use- Raymond Murphy ,Cambridge , New Third Edition

REFERENCE BOOKS:

1. New Interchange (English for International Communication) Jack C. Richards

SEMESTER-III

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDMTC03	Course Name : Mathematics – III	L: 3	T: 1	P: 0	C: 4
Year and Semester	II Year & III Semester		Contact hours per week (4Hrs)		
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
	✓				
Course Objective	1. To introduce the concept of Fourier series in engineering. 2. To impart the knowledge of first order partial differential equations in engineering. 3. To impart the knowledge of method second partial differential equations in engineering. 4. To introduce the notion of sampling distributions and statistical methods. 5. To discuss sampling techniques based on small and large sample data.				
Course Outcome	The student will be able to: 1. Tell Fourier series method and its applications. 2. Demonstrate partial differential equations techniques. 3. Make use of method partial differential equations in engineering 4. Outline knowledge how to present data and measures of central tendency and variation 5. Choose a decision about the value of a population parameter based on sample data. 6. Develop knowledge of different techniques of PDE and statistics.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	-	1	1	-	1	-	1	-	1

CO2	1	1	1	1	-	1	-	1	1	-	1	-	2	-	1
CO3	3	3	2	-	-	1	2	1	1	1	-	-	1	-	2
CO4	2	2	1	2	-	1	1	1	1	2	-	-	2	-	1
CO5	3	3	3	3	-	1	1	1	1	2	-	2	2	-	2
CO6	3	2	2	3	3	1	1	1	1	3	-	2	2	-	2
AVERAGE	2.16	2	1.5	2.25	3	1	1.25	1	1	2	1	2	1.6	0	1.5
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNITI: Fourier series **12Hours**

Definition of Fourier's series – Fourier Coefficients – Expansion of functions in Fourier series – Even and odd functions – Half range Fourier series for the interval *(-l, l)* - Harmonic analysis – Estimation of Fourier coefficients for given values of functions.

UNITII: Partial Differential Equations **12Hours**

Formation of partial differential equation – Solution of PDE by direct Integration – Lagrange's Linear First order equation- Nonlinear equations of First order – Four types.

UNITIII: Applications of Partial Differential Equations **12Hours**

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional heat equation (Equation of heat conduction).

UNIT IV: Basic Statistics **12Hours**

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal (No derivation) - evaluation of statistical parameters for these three Distributions, Correlation and regression – Rank correlation.

UNIT V: Testing of Hypothesis **12 Hours**

Sampling distributions –Testing hypothesis for mean, variance, proportions and difference using normal 't', 'chi square' and F- distributions –Tests for independence of attributes and goodness of fit.

TOTAL: 60 Hours

Text book:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S. ManicavachakamPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

Reference books:

1. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
3. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
4. John W Miles - Integral Transforms in Applied Mathematics, 1st Edition, Nov 2008, Cambridge University press.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA301	Course Name : INTRODUCTION TO NAVAL ARCHITECTURE	L	T	P	C
		3	0	0	3
Year and Semester	II Year & III Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. To understand various types of ships and shipyard process 2. To obtain a good knowledge on ship offset compilation and generation of Lines plan 3. To understand the preliminary concepts behind ship stability				
Course Outcome	After completion of the course, the students will be able to 1. Recall the Different types of ships and its rules. 2. Outline the various definitions and the terms used in naval architecture and ship building 3. Construct Lines plan – fairing process- table of offsets, Views of lines plan, stem and stern profiles 4. Develop ship shapes of different kinds of ship and their floating behavior in floating condition 5. Compare stability of ships at small and large angles 6. Develop the shape of particular ship and complete hydrostatic behavior including stability and trim of the ship under given floating condition				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-
CO2	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-
CO3	-	-	-	-	-	1	-	1	-	1	-	-	-	1	-
CO4	-	-	-	-	-	-	-	1	-	1	-	1	1	1	-

CO5	1	1	-	-	-	-	-	1	1	1	-	-	1	1	-
CO6	-	1	-	2	2	1	2	1	1	1	1	1	2	1	2
AVERAGE	1	1	-	2	2	1	2	1	1	1	1	1	1.3	1	2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – SHIP TYPES AND THEIR TERMINOLOGY **9 Hrs**

Introduction to the development of the merchant ship in the context of developing world trade, Basic design feature and ship terminology, Classification of ship by types and functions.

UNIT II - GENERAL ARRANGEMENT FOR DIFFERENT VESSELS **9 Hrs**

General arrangement related to the ship type including cargo and passenger ship, fishing vessels, warships, workboats and vessels for pleasure.

UNIT III - LINES PLAN AND INTEGRATION RULES **9 Hrs**

Lines plan – fairing process- table of offsets, Views of lines plan, stem and stern profiles, Forms of coefficients, Interaction rules – Trapezoidal rule, Simpson's rule (1-4-1, 1-3-3-1 and 5, 8,-1 rule), 6 ordinate rule, Tchebycheff's rule

UNIT IV - HYDROSTATIC CALCULATIONS **9 Hrs**

Calculations of areas, volumes, centroids, moment of inertia and second moment of inertia and other hydrostatic parameters

UNIT V - SECTIONAL AREA AND BONJEAN CURVES **9 Hrs**

Freeboard and load line regulation, Bonjean Curves, Sectional Area Curve, Cutting and Mould Loft

Total: 45 Hours

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA302	Course Name : MARINE MATERIALS AND WELDING TECHNOLOGY	L	T	P	C
		3	0	0	3
Year and Semester	II Year & III Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. To introduce the building blocks and principles in the area of shipbuilding materials. 2. To identify various materials used in the shipping industry. 3. To understand the general aspects of welding process				
Course Outcome	After completion of the course, the students will be able to 1.List various types of materials used in ship building industry 2. Explain the welding parameters associated with welding. 3. Experiment with the different metal joining techniques used in ship building. 4. Solve welding generated stresses and knowing the cause and remedy. 5. Criticize the difficulty in production process. 6. Apply industrial practice of standard methods of welding procedure.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	-	-	-	-	-	-	-	1	1	-	-	-	2	1	1
CO2	-	-	-	1	-	-	-	1	1	-	-	-	2	2	2
CO3	-	-	-	2	-	-	-	1	1	1	-	-	2	2	2
CO4	-	-	-	2	2	1	-	1	1	1	-	1	3	3	2
CO5	-	-	-	2	2	1	-	1	1	1	-	1	3	3	3
CO6	-	-	-	2	2	1	-	1	1	1	-	1	3	3	3
AVERAGE	-	-	-	2.25	2	1	-	1	1	1	-	1	2.5	2.3	2.1
CORRELATION LEVELS			1. SLIGHT(LOW)			2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)				

UNIT I–INTRODUCTION TO MARINE MATERIALS 9 Hrs

Introduction to Materials of construction and marine environment (Steel, Aluminum and Composites), fiber reinforced composites, Steel and Aluminum alloy in shipbuilding applications.

UNIT II - INTRODUCTION TO WELDING VARIABLES 9 Hrs

Welding Parameters, (Current, Arc Voltage, Speed, Feed, speed..etc.) , fusion welding power source, types and characteristics, metal transfer mechanism. Numerical problems related to heat generation.

UNIT III- WELDING METHODS IN SHIPBUILDING 9 Hrs

Fusion methods MMAW, GMAW, SAW, Electro gas welding, Electro slag welding, single side welding, multi electrode welding, FSW, Heat generation, Introduction to joining techniques used in composites in shipbuilding. Standard welding practices: WPS & PQR P-no, A-no, F-no, PQR – Sample WPS, PQR, WPQT.

UNIT IV- DEFECTS & DISTORTION IN WELDING 9 Hrs

Types of welding defects, Residual Stress, Distortion mechanism, distortion control through design, fabrication technique - Case study and remedial measures**.**

UNIT V - DESTRUCTIVE AND NON-DESTRUCTIVE TESTING 9 Hrs

Testing of materials and methods of Destructive testing, Non Destructive Test – Visual Inspection, Liquid Penetration Test, Radiographic Test – Introduction, principle, X-Ray radiography procedure, gamma ray, Magnetic Particle Test, Ultrasonic Test.

Total : 45 Hours

TEXT BOOKS

1. Nisith R. Mandal – Ship Construction and Welding, Springer, Volume 2,
2. Thomas Lamb - Ship Design and Construction, Volumes 1 and 2, published by Society of Naval Architects and Marine Engineers
3. Robert Taggart (1980), “Ship Design and Construction”, SNAME, USA.
4. George J. Bruce, David J. Eyres (2012), “Ship Construction”, Butterworth-Heinemann, 7th edition.
5. Ben C. Gerwick Jr. (2007), “Construction of Marine and Offshore Structures”, CRC Press, 3rd edition.

REFERENCES

1. Richard Little - Welding and Welding Technology, McGraw Hill, (2001), 1st edition.
2. Richard L. Storch, Colin P. Hammon, Howard M. Bunch (1988), “Ship Production”, Cornell Maritime Pr/Tidewater Publication, 1st edition.
3. Welding handbook - American Welding Society, (1983), 7th edition, volume 1 & 2, USA.

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code: UDNA303	Course Name : MARINE HYDRODYNAMICS		L	T	P	C
			3	1	0	4
Year and Semester	II Year & III Semester		Contact hours per week (4Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
Course Objective	To obtain a basic understanding of the fluid statics and kinematics To understand the ideal and viscous flow problems and their application in marine sector To learn the concepts behind aerofoil and its theory					
Course Outcome	After completion of the course, the students will be able to 1. Match the wide application of fluid mechanics in ship and wave hydrodynamics					

	2. Classify different types of flows and their characteristics 3. Explain the dynamics involved in fluid flow problems 4. Develop the wide application of combination of flows to obtain different arbitrary shapes 5. Apply the basic concepts involved in the viscous flow and the importance of boundary layer 6. Estimate different forces on the submerged bodies and the application of marine hydrodynamics in floating structure design

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	-	-	-	1	2	2	1	1	2	2	1
CO2	-	1	-	-	-	-	-	1	2	2	1	1	2	2	1
CO3	-	1	-	-	-	1	-	1	3	2	1	2	2	3	1
CO4	-	1	-	-	-	1	-	1	3	2	1	2	2	3	2
CO5	-	1	2	-	2	1	-	1	3	2	1	2	2	2	2
CO6	-	1	2	2	2	1	-	1	3	2	1	2	2	3	2
AVERAGE	-	1	2	2	2	1	-	1	2.6	2	1	1.6	2	2.5	1.5

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - FLUID STATICS AND KINEMATICS (12 Hours)

Fluid and their properties, pressure measurement and manometers, basic principles of hydrostatic forces on surfaces, buoyancy and floatation– Problems

Types of fluid flow; Lagrangian and Eulerian methods of flow description, substantial derivative, flow visualization, continuity equation, circulation and vorticity, velocity potential and stream function– Problems

UNIT II - IDEAL FLOW (14 Hours)

Equation of motion – Euler's equation of motion – Bernoulli's equation – Assumptions, problems, practical application – Venturimeter and pitot tube– Problems

Uniform flow, Source, Sink, Doublet, vortex flow –combination of flows - Magnus effect – Problems

UNIT III - VISCOUS FLOW (12 Hours)

Viscosity, Bernoulli's equation for real fluids, Flow through a pipe of circular section, Poiseuille law, flow of fluid between parallel plates– Coutte's law, NavierStoke's equation Dimensional and modal analysis, Reynold's and Froude number, Concepts of Boundary layer, Separation of Boundary Layer – Problems

UNIT IV – FLOW THROUGH PIPES (12 Hours)

Loss of energy in pipes – major and minor, Darcy-Weisbachequation,Chenzy's formula, pipes in series and parallel, equivalent pipe, concept of siphon, Flow through nozzles, concept of water hammer in pipes – Problems

UNIT V –FLOW PAST SUBMERGED BODIES (10Hours)

Introduction, Force Exerted by a flowing fluid on a stationary body, drag, lift forces – expression, Bluff body, streamlined body, terminal velocity, Karman-Vortex trail, Concept of added mass, Added mass of cylinders; Spheres and Lewis forms, Aerofoils- Flow around an aerofoil, stall point, Application of marine hydrodynamics in floating structure design – Problems**.**

Total : 60 Hours

TEXT BOOKS

1. R.K Bansal, A textbook of Fluid Mechanics, Laxmi Publications, 2008
2. S.K Som, Gautham Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Mc Graw Hill, 2011
3. G.S. Sawhney, Fundamentals of Fluid Mechanics, I K International Publishing, 2011

REFERENCES

1. Marine Hydrodynamics, Newman, J. N., Cambridge, MA: MIT Press, 1977
2. Applied Hydrodynamics, Vallentine, Newness - Butterworth, 1967.
3. Fluid Mechanics, Walther Kaufmann, Tata McGraw-Hill Publishing Co, Ltd., 1963.

Boundary Layer Theory, Schlichting, Springer Verlag, 2001	

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDMCC02	Course Name : STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3
Year and Semester	II Year & III Semester	Contact hours per week (3Hrs)			
Prerequisite course	Engineering mechanics				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. To understand about the concept of stress strain relationship 2. To draw the shear force and bending moment diagrams of beams under loads 3. To learn about the theory of simple bending				

	4. To study about the stresses on shells due to internal pressure 5. To understand about the concept of torsion of shafts 1. To calculate the torsion in springs
Course Outcome	After successful completion of the course, the students should be able to 1. Recall concept of stress-strain relationship on the bars with different loading conditions. 2. Construct shear force and bending moment diagrams of various beams under various load conditions. 3. Solve the bending stress of various section of beams. 4. Identify the impact of stresses on shells due to internal pressure 5. Discuss the maximum power and torque transmitted through Solid shafts and Hollow shafts 6. Discuss the maximum shock absorbing capacity of closed and open coil springs.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	1	1	1	1	1	1	2	-	1
CO2	2	2	-	-	-	1	1	1	2	1	1	1	2	-	1
CO3	2	2	2	2	-	1	1	1	2	1	1	1	1	-	1
CO4	2	2	2	2	-	2	2	1	2	1	-	1	1	1	1
CO5	2	2	2	2	-	2	2	1	3	1	-	1	1	1	1
CO6	2	2	2	2	-	2	2	1	3	1	-	1	1	1	1
AVERAGE	2	2	2	2	-	1.5	1.5	1	2.1	1	1	1	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT -1 DEFORMATION OF METALS **9 HOURS**

Stress and strain- Behaviour of mild steel in tension up to rupture – Stress – Strain diagram -Hooke's law- Simple problems in tension, compression and shear force. Problems connecting linear, lateral and volumetric deformation – Elastic constants and their relationship - Problems on elastic constants.

UNIT- II SHEAR FORCE AND BENDING MOMENT DIAGRAMS OF BEAMS **9 HOURS**

Classification of beams –shear force and Bending moment –types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram

UNIT – III THEORY OF BENDING **9 HOURS**

Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance – bending equation – M/I=f/y=E/R –section modulus - rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simple supported beam.

UNIT – IV THIN AND THICK SHELLS **9 HOURS**

Thin and thick cylindrical shell – Failure of thin cylindrical shell–Hoop and longitudinal stress simple problems – change in dimensions– problems –tensile stress induced in a thin spherical shell– simple problems – change in diameter and volume of a thin spherical shell- problems.

UNIT- V THEORY OF TORSION AND SPRINGS **9 HOURS**

Theory of torsion – Assumptions – torsion equation – strength of solid and hollow shafts – power transmitted –Polar modulus – Torsional rigidity – strength and stiffness of shafts –Problems. Types of springs – Laminated and coiled springs and applications – Types of coiled springs –closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs

TOTAL : 45 HOURS

TEXT BOOKS:

1. Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
2. Strength of materials, S.S.Rattan, Tata McGraw hill, New Delhi,2008, ISBN 9780070668959,

References

1. Strength of Materials, B K Sarkar, I Edition, 2003 Tata McGraw hill, New Delhi.
2. Strength of Materials, S. Ramamrutham, 15th Edn 2004, DhanpatRai Pub. Co., New Delhi.

Designed by	" Department of Naval Architecture & Offshore Engineering"

<table>
<tr><td>PROGRAMME</td><td colspan="5">BE-Naval Architecture & Offshore Engineering</td></tr>
<tr><td>Course Code
UDMCC01</td><td>Course Name :
MATERIAL SCIENCE</td><td>L
2</td><td>T
0</td><td>P
0</td><td>C
2</td></tr>
<tr><td colspan="6">(Common for BE (ME, NA, PE & MECH))</td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year & III Semester</td><td colspan="3" rowspan="2">Contact hours per week
(2 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">NIL</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="2">Professional Elective</td></tr>
<tr><td></td><td></td><td>✓</td><td colspan="2"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="2">Mandatory</td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Course Objectives</td><td colspan="5">The purpose of this course is to provide comprehensive knowledge about various materials used in production of engineering applications</td></tr>
<tr><td rowspan="2">Course Outcome</td><td colspan="5">At the end of this course students should be able to</td></tr>
<tr><td>1</td><td colspan="4">Select the materials and their alloys phases through phase diagram.</td></tr>
</table>

	2	List various heat treatment methods applied on materials
	3	Demonstrate the various properties of engineering materials
	4	Interpret the behaviour of materials under force and their testing methods
	5	Inspect the mechanism of corrosion and factors influencing corrosion
	6	List basic aspects of advanced engineering materials and their applications in marine industry

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	1	2	1	1	1	2	-	-
CO2	-	-	-	-	-	1	1	1	2	1	1	1	2	-	-
CO3	-	-	2	2	-	1	1	1	2	1	1	1	1	-	-
CO4	2	2	2	2	-	1	1	1	2	1	1	1	1	1	-
CO5	2	2	2	2	-	1	1	1	2	1	1	1	1	1	-
CO6	2	2	2	2	-	1	1	1	2	1	1	1	1	1	-
AVERAGE	2	2	2	2	-	1	1	1	2	1	1	1	1.3	1	-
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)		

UNIT 1 - MATERIALS SCIENCE AND ENGINEERING **6Hrs**

Introduction, Developments in materials, engineering profession and materials, Classification of materials, criteria for selection of materials for the required application, ferrous materials: Cast iron, Steel, Stainless Steel, Prominent alloy steel. Non-Ferrous materials: Copper, Brass, Bronze, Aluminium, Lead, Tin, Titanium. Materials for High and Low temperature service, classification of heat resistant materials

UNIT 2 - PROPERTIES OF MATERIALS **6Hrs**

Mechanical Properties: Hardness, Strength, Toughness, Stiffness, Ductility, Malleability, Harden ability, creep and fatigue Electrical properties: Conduction, Semiconductors and insulators Optical properties: Absorption, Reflection, Transmission and Refraction optical fibres and lasers. Magnetic properties: Various types of magnetic materials, Diamagnetic, Paramagnetic, Ferromagnetic, Ferrites, hard and soft magnetic materials Thermal properties: Thermal expansion, Heat capacity, Thermal conduction, Thermal Stresses.

UNIT 3 - HEAT TREATMENT **6Hrs**

Heat treatment - Annealing, Normalizing, Hardening, Tempering Case Hardening – Carburizing, Nitriding, Cyaniding and carbon nitriding, Flame hardening, Induction Hardening

UNIT 4 - MATERIAL TESTING **6Hrs**

Study of fractures of engineering materials - Elastic deformation, Plastic deformation, Stress- Strain diagrams; Properties obtained from the tensile test Destructive testing - Tensile testing, compression testing, Impact Testing, Hardness test, Jominy end quench test for harden ability of steel. Non-destructive testing – Visual Inspection, Hammer test, Radiography, Magnetic particle inspection, Liquid Dye penetration test, Ultrasonic inspection test

UNIT 5 - MATERIALS ENVIRONMENT INTERACTIONS **6Hrs**

Principles of corrosion, factors influencing corrosion, Basic Mechanism of corrosion, Electro-chemical corrosion, direct dissolution mechanisms, Dry and wet corrosion, galvanic corrosion. Methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, corrosion monitoring.

Total : 30 Hours

TEXT BOOKS 1 Callister william D.Jr, “Material Science and Engineering an Introduction”, John Wiley & sons inc. 2 O.P.Khanna, “Material Science and Metallurgy”, Dhanpat Rai Publications, 2014 edition. **REFERENCES** 1 Schaeffer J.P: Saxena A, Antolovich S.D, Sanders T.H. Jr., Warner S.B., “The Science & Design of Engineering Materials”, McGraw-Hill International 2 Askeland Donald R. and Phule P.P., “The science and engineering materials”, Thomson learning.

Designed by	“ Department of Mechanical Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA3PA	Course Name : STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	2	1
Year and Semester	II Year & III Semester		Contact hours per week (2Hrs)		
Prerequisite course					
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. To learn about different types of testing methods of metals. 2. To evaluate material testing on elasticity				

	3. To evaluate material testing on hardness 4. To evaluate material testing on shear strength 5. To Determine modulus of rigidity of open spring and closed coil springs.
Course Outcome	After successful completion of the course, the students should be able to 1. Evaluate the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test. 2. Develop the procedure to perform Hardness test and finding hardness number with various specimens 3. Experiment with Deflection test on Mild Steel, Aluminium to find the young's modulus. 4. Estimate the modulus of rigidity of Mild steel using torsion test 5. Estimate the stiffness of the open coil and closed coil spring and grade them. 6. Experiment with given specimen to find the compression strength and fatigue strength and impact strength of materials.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	3	-	1	3	3	-	3	3	1	1
CO2	3	3	3	-	-	3	-	1	3	3	-	3	2	1	1
CO3	3	2	2	-	-	3	-	1	3	3	-	3	2	1	1
CO4	3	3	3	-	-	3	-	1	3	3	-	3	3	1	1
CO5	3	3	3	-	-	3	-	1	3	3	-	3	3	1	1
CO6	3	2	2	-	-	3	-	1	3	3	-	3	2	1	1
AVERAGE	3	2.7	2.7	-	-	3	-	1	3	3	-	3	2.5	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

LIST OF EXPERIMENTS

1. Test on Ductile Materials: Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
2. Hardness Test: Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
3. Beam Deflection Test: Deflection test on Mild steel and Aluminium– relation between load and deflection.
4. Impact test: Finding the resistance of materials to impact loads by Izod test and Charpy test.
5. Tests on springs of circular section: Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open / Closed coil spring)
6. Shear test: Single or double shear test on M.S. bar to finding the resistance of material to shear load.
7. Cupping Test: Testing the deformability of a sheet and Finding the Cupping number.

TOTAL : 30 HOURS

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UCLECPD	Spoken English III	0	0	2	1
Year and Semester	II Year & III Semester	Contact hours per week			
Prerequisite course	Basic Language Skills	(2 Hrs)			
	Humanities and Social Sciences / **Management courses**	**Professional Core**		**Professional Elective**	

Course category				
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**
	√			

Course Objective	1. Learn various aspects of different cultures and the need for the effective interpersonal communication 2. Understanding the techniques of communication between friends and between members in group 3. Use of language effectively at interpersonal communicational situations to avoid conflict and tension. 4. Mould the personality so as to reduce and repair conflicts 5. Learn the need for socialization.
Course Outcome	At the end of the course, the student should be able to: 1. Recognize aspects of various cultures and the need for interpersonal communication. Give presentation without any inhibition 2. Demonstrate the need for effective communication between two people/groups. 3. Make use of effective and appropriate language at various interpersonal situations to avoid conflict, tension and stress. Participate in debates and discussions to argue effectively and persuasively. 4. Practice the IP principles so as to reduce and repair conflict in interpersonal relationships. 5. Explain family and social relationships and need for socialization. 6. Discuss case studies in relation to IPC

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1								2	2	2				1	1
CO2								2		2				1	1
CO3								2		2				1	1
CO4								2		2				1	1
CO5								2	2					1	1
CO6								2						1	1
AVERAGE								2	2	2				1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

Unit I: PRESENTATION SKILLS **(6 Hours)**

Axioms of interpersonal Communication - One minute presentation – Extempore - Formal Presentation on the chosen topics - Greeting and Introducing - Offering Help.

Unit II: APPREHENSION AND ASSERTIVENESS **(6 Hours)**

Group Discussion - Aggressiveness and assertiveness - perception in interpersonal communication-Making Requests - Telephonic Conversation

Unit III: VERBAL AND NON VERBAL MESSAGES **(6 Hours)**

Word Stress - Sentence Stress and Intonation-Body language-signs- gestures- postures- kinesics- paralinguistic features (accent, pronunciation, volume, pause, and pitch).

Unit IV: POWER IN INTERPERSONAL RELATIONSHIP **(6 Hours)**

Conflict in interpersonal relationships - Conflict Resolution - Relationship maintenance and repair-Asking and Giving Permission-Giving Instructions and Directions

Unit V: SOCIALIZATION **(6 Hours)**

Benefits of socialization- Effect of social media - Case studies (common /domestic /academic /work situations).

Total: 30 Hours

Reference Books

1. *DeVito, Joseph,* The *Interpersonal Communication* Book, 13th Edition**,** Published by *Longman* Pub Group*,* Updated in its *13th edition,* 2000.

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code:	Course Name :		L	T	P	C
UDNA3PC	SHIP DRAWING- LINES PLAN		0	0	3	2
Year and Semester	II Year & III Semester		Contact hours per week (3Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective		
			✓			
	Basic Science	Engineering Science	Open Elective	Mandatory		

Course Objective	1.To draw lines plan of a vessel manually and initiate in CAD software
Course Outcome	After completion of the course, the students will be able to 1. Design the complete lines plan of the given vessel manually 2. Develop Offset table manually 3. Create CAD drawing of lines plan 4. Develop the Bonjean Curves manually 5. Predict different views of the ship and draw manually 6. Design faired sets of lines plan including the faired offset table which can be directly used by the CNC machine for the fabrication Of the hull

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	3	3	1	-	1	-	-	-	1	3	3	3
CO2	-	-	-	2	2	-	-	2	-	-	-	1	3	3	3
CO3	-	-	-	3	1	1	-	1	-	-	-	1	3	3	3
CO4	-	-	-	3	2	1	-	1	-	-	-	1	3	3	3
CO5	-	-	-	3	3	2	-	1	-	-	-	1	3	3	3
CO6	-	-	-	3	3	3	-	-	-	-	-	1	3	3	3
AVERAGE	-	-	-	2.8	2.3	1.6	-	1.2	-	-	-	1	3	3	3
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

LINES PLAN

Drawing lines plan manually using the derived offset table.

OFFSET

Deriving the Faired, Offset table

CAD DRAFTING

Basic CAD commands, drawing of lines plan in CAD software

BONJEAN CURVES

Calculation of Bonjean curves & plotting it manually and in CAD software

Total: 45 Hours

TEXT BOOKS:

1. The Society of Naval Architecture & Marine Engineers,1980
2. Eric c. Tupper, Introduction to Naval Architecture
3. Principle of Naval Architecture by Edward V.Lewis, Volume- I.

REFERENCES:

1. Robert Taggard, Ship Design & Construction.

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SEMESTER-IV

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA401	Course Name : THERMODYNAMICS AND MARINE MACHINERY	L	T	P	C
		3	0	0	3
Year and Semester	II Year & IV Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective

1. This course provides basic knowledge about thermodynamics.
2. To understand about concepts of heat transfer.
3. To understand the heat flow direction.
4. Provide the knowledge about marine engines.

Course Outcome

After completion of the course, the students will be able to

1. Define thermodynamics laws and their application
2. Explain the knowledge on concept of entropy and availability
3. Illustrate the thermodynamics cycles and their applications
4. What is enthalpy, reversible and irreversibility
5. Distinguish various machines used in marine vehicles
6. Discuss the concept of heat flow.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	2	-	1	-	-	1	1	2	-	1	1	2	2
CO2	1	-	2	-	1	-	-	1	1	2	-	1	1	2	2
CO3	1	1	2	-	1	-	-	1	2	2	-	1	1	2	2
CO4	1	1	2	-	1	-	-	1	2	2	-	1	1	2	2
CO5	1	1	2	-	1	-	-	1	2	2	-	1	1	2	2
CO6	1	1	1	-	1	-	-	1	2	2	-	1	1	2	2
AVERAGE	1	1	1.8	-	1	-	-	1	1.7	2	-	1	1	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

Unit I:Basic Concepts **9Hrs**

Concept of Continuum, Comparison of microscopic and macroscopic approach, Path and point functions; intensive and extensive properties, specific quantities, Systems, Quasi static Process, reversible and irreversible Processes; Heat and work transfer; Zeroth law of thermodynamics – concept of temperature and thermal equilibrium.

Unit II:First law of Thermodynamics **9Hrs**

Concept of energy and various forms of energy; specific heats; first law applied to elementary processes, closed systems and control volumes, steady and unsteady flow processes, internal energy, enthalpy.

Unit III :Second Law of Thermodynamics **9Hrs**

Heat reservoir, Source and Sink; Heat Engine, Refrigerator and Heat Pump; Statement of second laws, Carnot cycle and Reversed Carnot cycle, Clausius inequality, concept of entropy, entropy change for - pure substance, ideal gases, T-s diagrams; third law of thermodynamics, Available and non-available energy of a source

Unit IV:Thermodynamics cycles **9Hrs**

Air-standard Brayton cycle, Carnot vapor cycle, Rankine reheat cycle, ideal Rankine cycle, air-standard Otto cycle, air-standard Diesel cycle, vapor-compression refrigeration cycle.

Unit V:Marine Machineries **9Hrs**

Diesel Engines, Marine Auxiliary machineries and controls, Naval Architecture and Marine electrical machineries.

Total hours:45 Hours

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, 5thEdition, Tata McGraw-Hill, New Delhi, 2008
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 7th Edition, Tata McGraw Hill, 2010
3. DrSavithri, Mukesh, Sakthivel, “ Engineering Thermodynamics”, 1st Edition, ARS Publications, 2017
4. HDMcGeorge,”MarineAuxiliary Machinery"7thedition, Butter Worths, London, 2001.

REFERENCES

1. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012
2. Holman.J.P., "Thermodynamics", 3rd Edition, McGraw-Hill
3. Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice-Hall of India Pvt. Ltd
4. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2010
5. DW Smith “Marine Auxiliary Machinery”, 6th edition, Butter Worths, London, 1987.

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA402	Course Name : MARINE PRODUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

Year and Semester	II Year & IV Semester		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	

	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective

1. This course provides basic knowledge about shipyards.
2. To provide the classification and functions various ship structures.
3. Provide the knowledge about classification society.
   To understand the testing methods of ship structures.

Course Outcome

1. List the ship terms and shipyard functions
2. Compare the knowledge about basic ship structures
3. Compare the knowledge about various classification societies and their responsibilities
4. Summarize Shipyard practices
5. Elaborate about the latest technologies in shipbuilding
6. Compare the testing methods of ship structures

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	1	1	-	1	1	1	1	-	1	2	2
CO2	-	-	-	1	1	1	-	1	1	1	1	-	1	2	2
CO3	-	-	-	1	1	1	-	1	1	1	1	-	1	2	2
CO4	-	-	-	1	1	1	-	1	1	1	1	-	1	2	2
CO5	-	-	-	2	1	1	-	1	2	2	2	-	1	2	2
CO6	-	-	-	2	1	1	-	1	2	2	2	-	1	2	2
AVERAGE	-	-	-	1.3	1	1	-	1	1.3	1.3	1.3	-	1	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

Unit I:Introduction **9Hrs**

Ship Terms; Classification of ships; Shipyard facilities, Shipyard layout, Steel stockyard - material preparation – straightening of plates, sand blasting and their standards; Rule requirements - Stresses in Ship's structure: Hogging – Sagging – Racking – Pounding – Panting

Unit II:Ship Structures **9Hrs**

Basic Structures – Double Bottom , Side Shell or Side Tanks, Main Deck Structures, Bulkheads, Fore Peak and Aft peak, Super Structures – Accommodation decks and Forecastle Deck; Rudder and their types; Propeller and their types;

Unit III:Classification Societies **9Hrs**

Classification societies, Steel Standards – Steel Grades, Inspections; Hull fabrication; IACS new building standards; Periodical Surveys; Surveys During Fabrication

Unit IV:Shipyard Practices **9Hrs**

Plate preparation, Prefabricaton – Nesting, lofting, bending – cold bending, heat line bending; Fabrication – assembly of structural panels, units and blocks, inspections during production, Erection of ship's hull and their problems; Launching

Unit V:Advanced Technologies
9Hrs

Robotic Welding; Ship lift, group technology, Laser application.

Total hours:45 Hours

TEXT BOOKS

1. George J. Bruce, David J. Eyres (2012), "Ship Construction", Butterworth-Heinemann, 7th edition.
2. Robert Taggart, "Ship Design and Construction", SNAME, USA.
3. Stokoe, E.A., "Reed's Ship Construction for Marine Engineers", 1st Edition, Thomas Reed Publication, London, 2000.

REFERENCES

1. Richard Lee Storch, Colin P. Hammon, Howard McRaven Bunch, and Richard C. Moore, "Ship Production, 1st Ed., SNAME,1995
2. H.J. Pursey, "Merchant Ship Construction", 7th Edition, Brown Son & Ferguson Ltd. Glasgow Great Britain, 1994.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA403	Course Name : ELEMENTS OF OFFSHORE ENGINEERING	L	T	P	C
		3	1	0	4
Year and Semester	II Year & IV Semester	Contact hours per week (4Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. This course provides basic knowledge about water waves. 2. To provide the classification and functions various Offshore structures. 3. To understand the installation methods of offshore structures. 4. Provide the knowledge about construction materials. 5. To understand the testing methods of offshore structures.
Course Outcome	After completion of the course, the students will be able to 1. Define the water wave mechanics. 2. Distinguish the different types of offshore structures and their applications 3. Distinguish the elements and installation methods of offshore structures 4. Predict material for offshore structures 5. Choose Inspection and maintenance of offshore structures 6. Criticize different types of offshore structures elements, material used for structures and installation methods

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CO2	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CO3	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CO4	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CO5	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CO6	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
AVERAGE	-	-	-	-	1	-	-	1	-	-	2	1	1	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNITI– INTRODUCTION TO WATER WAVE MECHANICS **12 Hours**

Ocean Waves – Types , Regular and Random wave description, waves and their properties, Irregular Sea – Analysis methods, Regular waves - Linear wave theory, Boundary conditions, assumptions, Governing Equations,– Dispersion relation, water particle kinematics, orbital motion; Group velocity and its dynamical significance, waves behaviour in deep water and shallow water, wave pressure, energy and power; Wave deformation basics - Problems.

UNIT II -CLASSIFICATION OF OFFSHORE STRUCTURES **12 Hours**

Ocean energy and fundamental principles of energy extractions from sea water , Deepwater challenges Introduction to Offshore Structures: Functions of Offshore Structures
Types of Offshore structures, Sub Sea systems and pipe lines. Various environmental loads acting on offshore structures

UNIT III –OFFSHORE STRUCTURE ELEMENTS AND INSTALLATION **12 Hours**

Regulations and codes of practice. Topsides and General layout Considerations of offshore platforms. Foundation systems for offshore structures, Towing, launching and installation of offshore structures and pipe lines. Fundamentals of mooring system and mooring cables, Riser – different types of risers, Dredging methods and equipments.

UNIT IV –MATERIAL FOR OFFSHORE CONSTRUCTION **12 Hours**

Materials for marine applications, Different types of materials and their applications in marine environment, Properties and selection of materials for marine environment , Corrosion and corrosion protection methods, Introduction to composites for marine environment, Codes of practice for materials in marine environment

UNIT V–INSPECTION AND MAINTENANCE OF OFFSHORE STRUCTURES **12 Hours**

Inspection and testing of offshore structures- methods and equipments- non-destructive methods. Structural health monitoring and Repair of offshore structures**.**

Case study on existing offshore renewable energy systems

Total: 60 Hours

TEXT BOOKS

1. Subrata K Ckakrabarti., Handbook of Offshore Engineering Vol
2. Dawson, T.H., Offshore Structural Engineering Prentice Hall, 1983
3. Water wave mechanics for engineers and scientists by Robert G Dean and Robert ADalrymple
4. Coastal Hydrodynamics -Mani J.S (2011) PHI Learning Pvt. Ltd
5. Water waves and ship hydrodynamics by Hermans, A.J.
6. ChakrabartiS.K. 1987. "Hydrodynamics of offshore structures ". WIT Press, Southampton, ,UK.

REFERENCE BOOKS

1.Graff, W.J., Introduction to Offshore Structures, Gulf Publ. Co. 1981

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA404	Course Name : Theory of Ships	L	T	P	C
		2	1	0	3
Year and Semester	II Year & IV Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. This course provides basic knowledge about ship. 2. To provide the concept of vessel stability. 3. Functions of classification society.
Course Outcome	After completion of the course, the students will be able to 1. Tell basic knowledge on type of ships and its parts. 2. Explain about Shipyard process and its production. 3. Design lines plan of a ship and its hydrostatic calculation. 4. Discuss the basic concepts of Ship stability 5. Discuss about the Transverse and Longitudinal Stability 6. Summarize Stability of ship in damage condition

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	-	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	-	-	1	-	-	1	1	2	2	1	1	2	2
CO4	2	2	-	1	1	-	-	1	1	2	2	1	1	2	2
CO5	2	2	-	1	1	-	-	1	1	2	2	1	1	2	2
CO6	2	2	-	1	1	-	-	1	1	2	2	1	1	2	2
AVERAGE	2	2	-	1	1	-	-	1	1	2	2	1	1	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I-INTRODUCTION 9Hr

s

Historical developments of ships and shipping transport, Ship Terms, Role of Classification and other regulatory bodies, Type of ships. Ships for transport, Ships for Defence, Main particulars and form coefficients.

UNIT II-CARGO EFFECT ON STABILITY 9Hrs

Effect of weights on C.O.G (shifting, lifting, loading & unloading); Equivolume inclinations - shift of C.O.B. due to inclinations; Moments due to wind, shift of cargo, passengers, turning and non-symmetrical accumulation of ice; Effect of superstructure on stability

UNIT III-TRANSVERSE STABILITY 9Hrs

Initial stability GM, GZ at small angles of inclinations, wall sided ships; Free Surface effects, Effect of grain on Cargo; inclining experiment; MCH (Moment Changing Heel).

Large angle stability - Diagram of statically stability (GZ - curve), Characteristics of GZ - curve, static equilibrium criteria; Methods for calculating the GZ – curve, Cross curves of stability; Dynamical stability - diagram of Dynamical stability, Dynamical stability criteria. Stiff/ Tender ship, Wind and heeling effect, IMO criteria

UNIT IV-LONGITUDINAL STABILITY 9Hrs

Trim, longitudinal metacentre, longitudinal centre of flotation; Moment to change trim, Trimming moment; Trim calculations - addition, removal and transference of weight, change of density of water, ballasting, launching

Stability while docking and grounding

UNIT V-DAMAGE STABILITY 9Hrs

Damage stability - Deterministic and Probabilistic approach; Recommendations of classification societies and governmental authorities - Intact and damage stability rules, Bilging of compartment

Flooding calculation, Floodable length

Practical: Stability check of M. V. HINDSHIP – Trim and Stability Booklet and launching calculations

Total:45 Hours

TEXT BOOK

1.Edward V Lewis, Principle of Naval Architecture, Vol-1, III EDITION, The Society of Naval Architects and Marine Engineers, 1988

2.K. J. Rawson & E. C. Tupper, Basic Ship Theory, V Edition, Butterworth Heinmann, 2001

REFERENCES

1.E. C. Tupper, Introduction to Naval Architecture, III Edition, Butterworth Heinmann, 2002

2. C. B. Barrass and Captain D. R. Derrett, Ship Stability for Masters and Mates, Elsevier, 2006.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code:	Course Name :	L	T	P	C
UDVCC04	Ethics and Values	3	0	0	3
Year and Semester	II Year & IV Semester	Contact hours per week (3Hrs)			

Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	✓			
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective

1.To understand the importance of engineering ethics

2.To learn the various steps and ways to resolve the ethical issues in engineering design and practice

3.To inculcate the importance of human values and practice them in personal and professional life

Course Outcome

After the completion of the course, the students will be able to

1. Define ethics, its types and importance in engineering course
2. Explain ethical dilemmas, code of ethics of professional engineering societies
3. Identify various ethical theories and know the applications to engineering situations
4. Examine issues surrounding the engineer's duty and understand how computers have been used unethically
5. Classify dimensions of human values and its practice in personal and professional life.
6. Elaborate the importance of ethics and human values in society

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	3	-	-	1	-	1	-	1
CO2	-	-	-	-	-	3	-	3	2	1	2	-	1	2	1
CO3	-	-	-	-	-	-	-	3	-	2	2	-	1	2	1
CO4	-	-	-	-	-	1	-	3	2	3	2	-	1	2	1
CO5	-	-	-	-	-	2	-	3	1	3	2	-	1	1	1
CO6	-	-	-	-	-	2	-	3	1	2	1	-	1	-	1
AVERAGE	-	-	-	-	-	1.5	-	3	1	1.8	1.6	-	1	1.1	1
CORRELATION LEVELS		1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT I–Introduction to professional ethics **8 hours**

Definition of profession, engineering and professionalism, dimension of engineering, definition of ethics and moral values, types of ethics – business, personal and professional ethics. Engineering ethics – preventive ethics and aspirational ethics, aspirational ethics and professional characters of a good engineer-Case study: Space shuttle challenger and Columbia accidents

UNIT II –Moral reasoning and code of ethics **9 hours**

Moral choices and ethical dilemmas, steps in resolving ethical dilemmas, right-wrong or better-worse, moral decision making as design Code of ethics–engineering standards, importance of codes, abuse of codes, limitations of codes, ethical relativism, justification of codes

UNIT III –Moral frameworks and workplace responsibilities **10 hours**

Determining the facts - known and unknown facts, weighing the importance of facts, rights ethics, duty ethics and utilitarianism. Utilitarian thinking–the cost-benefit approach, the act-utilitarian approach, the rule-utilitarian approach, virtue ethics, self-realization ethics, ethical egoism Professional responsibilities and rights, confidentiality and conflicts of interests, whistle blowing, honesty and research integrity

UNIT IV –Ethical issues in engineering practice **10 hours**

Analysis of issues in ethical problems - line drawing, flow charting, conflict problems, environmental ethics – engineering, ecology and economics, environmental moral frameworks, computer ethics – the internet and free speech, property, privacy and additional issues-An application of problem solving methods; Bribery/Acceptance of gifts

UNITV – Human values **8 hours**

Human Life: Concept of a successful life, happy life and a meaningful life. Harmony in Personal and Social Life, Creating a value based work culture, Human values: Character, Humility, Righteousness, Purity,

Truthfulness, Integrity, Self-restraint, Self-control, and Sense of responsibility, Empathy, Love, Compassion, Cooperation and Tolerance. New dimension of Global Harmony: Democracy, Equality and Social Justice

Total: 45 Hours

TEXT BOOKS

1. Mike W Martin, Introduction to engineering ethics, 2nd edition, McGraw Hill Higher Education, New York, 2010
2. Charles B Fleddermann, Engineering ethics, 4th edition, Prentice Hall, NJ, 2012
3. Charles E Harris, Michael S Pritchard, Michael J Rabins, Engineering ethics – Concepts and Cases, 4th edition, Wadsworth, USA, 2009
4. R.R Gaur, R Sangal, G P Bagaria, A foundation course in human values and professional ethics, Excel books, New Delhi, 2010

REFERENCES

1. Caroline White back, Ethics in Engineering Practice and Research, 2nd edition, Cambridge University Press, New York, 2011.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	**L**	**T**	**P**	**C**
UDNAO01	BASIC PRINCIPLES OF MARINE VESSEL DESIGN	3	0	0	3

Year and Semester	II Year (SEMESTER VI)		Contact hours per week (3 Hrs)	
Prerequisite course				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Aim / Purpose of the course	*To understand and apply the various steps involved in the various process of marine vehicle design*			
Instructional objective of the course	Students will be able to			
	1	Defining the Marine Environment		
	2	Illustrating the design process of a Marine Vessel Design		
	3	Identify the stability of floating structure		
	4	Analyse the ship resistance and powering		
	5	Assess ship motions and hull form design		
	6	Adapt the marine vehicle structural design philosophy		

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)		2. MODERATE(MEDIUM)								3. SUBSTANTIAL(HIGH)			

UNIT I - MARINE ENVIRONMENT **9Hrs**

Ocean Waves, Regular waves, Irregular waves, Beaufort scale, Sea state conditions – Ocean data collection

UNIT II – DESIGN PROCESS **9Hrs**

Market Study, Mission requirement, , Identifying the customer needs, System design, System Integration, Design process, Design spiral, Design Stages, Vehicle parameter estimation

UNIT III – STABILITY OF MARINE VESSELS **9Hrs**

Hydrostatics, Intact stability, Initial stability, Stability at large angles, Trim, Damage Stability

UNIT IV – HYDRODYNAMIC DESIGN **9Hrs**

Ship Resistance components, Estimation of ship resistance, Propulsion characteristics, Ship powering, model tests, Ship Motions, Ship maneuvering, Hullform design

UNIT V - STRUCTURAL DESIGN **9Hrs**

Ship building materials, Ship structural components and scantlings, Midship section design, Longitudinal strength, Typical midship sections of bulk carrier, oiltanker and container ships

Total: 45 Hours

TEXT BOOKS

1. Ship Design Methodologies of Preliminary Design by ApostolosPapanikolaou

2. Practical Ship Design by D.G.M Watson
3. Ship Design for Efficiency and Economy byH. Schneekluth and V. Bertram
4. Ship Design and Construction by R.Taggart

REFERENCES

1. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	**L**	**T**	**P**	**C**
UDNAO02	MARINE POLLUTION REGULATIONS	3	0	0	3
Year and Semester	II Year (SEMESTER IV)	Contact hours per week			

Prerequisite course	NIL		(3 Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Aim / Purpose of the course	Students inculcate the measures and standard to prevent the marine pollution.			
Instructional objectives of the course	Students will be able to			
	1	Defining the nature of pollution and its possible sources.		
	2	Demonstrate the law of the sea key provisions.		
	3	Apply measures and understand the requirement of pollution from oil and harmful substances.		
	4	Assess the prevention of pollution from sewage and garbage.		
	5	Evaluate the air pollution from ships during the initial phase of design.		
	6	Improve the learning for a safe and sound design of ships.		

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	-	-	-	-	2	-	1	-
CO2	-	-	-	-	-	1	1	1	1	2	2	2	-	1	-
CO3	-	-	1	1	1	1	1	2	1	-	1	2	-	1	1
CO4	1	-	1	1	-	1	2	-	1	-	2	2	-	1	1
CO5	-	1	1	1	-	1	2	-	1	-	2	2	-	1	1
CO6	-	-	1	-	-	1	1	2	1	-	1	2	2	1	1
AVERAGE	1	1	1	1	1	1	1.4	1.4	1	2	2	2	2	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – INTRODUCTION **9Hrs**

The oceans – Maritime zones; Need for marine environment protection; Sources of marine pollution.

UNIT II –THE LAW OF THE SEA **9Hrs**

The law of the sea and marine pollution – Navigation, exclusive economic zone, continental shelf, deep seabed mining, exploitation regime, marine scientific research.

UNIT III – POLLUTION FROM OIL & HARMFUL SUBSTANCES **9Hrs**

Prevention of pollution by oil – operational measures and accidental discharges; Double hulls standards.

Control of pollution by noxious liquid substances in bulk – discharge criteria and measures; Types of substances; residues discharge concentrations and conditions.

Prevention of pollution by harmful substances Carried by Sea in Packaged Form – requirements of standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications; Introduction to International Maritime Dangerous Goods Code (IMDG code).

UNIT IV – POLLUTION BY SEWAGE AND GARBAGE FROM SHIP **9Hrs**

Need for pollution control by sewage/garbage; Measures for dumping the garbage; Disinfected sewage disposal and measures.

Types of garbage onboard ships; Measures for dumping the garbage; Disposal of all form of plastics into sea.

UNIT V –PREVENTION OF AIR POLLUTION FROM SHIPS **9Hrs**

Limits on Sulphur oxide and Nitrogen oxide emissions from ship exhausts; Designated emission control areas; Stringent standards for SOx, NOx and particulate matter; Mandatory technical and operational energy efficiency measures.

Total:45 hrs

TEXT BOOKS:

1. International Maritime Organization (IMO) conventions, International Convention for the Prevention of Pollution from Ships (MARPOL), United Kingdom, 2005.
2. United Nations, United Nations Convention on the Law of the Sea, New York.
3. J.W. Doerffer, Oil Spill Response in the Marine Environment,Pergamon Press, 1992, ISBN 0-08-041000-6.

REFERENCES:

1. John H. Bates, UK Marine Pollution Law, Lloyd's of London Press, 1985, ISBN 1-85044-028-X.
2. Ricardo Beiras, Marine Pollution–Sources, Fate and Effects of Pollutants in Coastal Ecosystems, Elsevier, 2018.
3. R.B. Clark, C. Frid and M Atttrill, Marine Pollution, 4th Edition, Oxford Science Publications, 1997, ISBN 0-19-850069-6.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering

<table>
<tr><td>Course Code

UDLECPD</td><td colspan="2">Course Name :

English Laboratory - IV</td><td>L

0</td><td>T

0</td><td>P

2</td><td>C

1</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td>Year and Semester</td><td colspan="2">II Year & IV Semester</td><td colspan="3" rowspan="2">Contact hours per week

(2 Hrs)</td></tr>
<tr><td>Prerequisite course</td><td colspan="2">Basic Language Skills</td></tr>
<tr><td rowspan="4">Course category</td><td>Humanities and Social Sciences</td><td>Management courses</td><td>Professional Core</td><td colspan="3">Professional Elective</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Basic Science</td><td>Engineering Science</td><td>Open Elective</td><td colspan="3">Mandatory</td></tr>
<tr><td>✓</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>Course Objective</td><td colspan="6">1. Enhance the Employability and Career Skills of students
2. Enlighten the students towards effective skills for career development
3. Prepare themselves for interviews and develop their confidence
4. Deliver short speeches in front of an audience
5. Prepare effective and impressive CV and Cover Letters</td></tr>
<tr><td>Course Outcome</td><td colspan="6">At the end of the course, the student should be able to:
1. Prepare how to face an interview
2. Present effective speeches using verbal and non verbal techniques
3. Use appropriate vocabulary in formal communication
4. Write CVs effectively and persuasively
5. Comprehend different genres of speech and the implied meanings effectively
6. Participate in Group discussions and debates effectively</td></tr>
</table>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO_1	-	-	-	-	-	-	-	1	-	3	-	-
CO_2	-	-	-	-	-	-	-	1		3		
CO_3	-	-	-	-	-	-	-	1		3		
CO_4	-	-	-	-	-	-	-	1		3		
CO_5	-	-	-	-	-	-	-	1		3		
CO_6	-	-	-	-	-	-	-	1	2	3		
AVERAGE	-	-	-	-	-	-	-	1	2	3		
CORRELATION LEVELS			1.SLIGHT(LOW)			2.MODERATE(MEDIUM)				3.SUBSTANTIAL(HIGH)		

UNIT I **(6 Hours)**

Introduction to Professional communication – importance of Soft Skills – Hard skills – employability and career Skills – Grooming as a professional with values - Time Management.

UNIT II **(6 Hours)**

Presentation Skills – Self-Introduction – Individual presentation on current affairs - technical presentations – role play.

UNIT III **(6 Hours)**

Planning a Resume'- writing a resume- writing application letters - understanding the interview process -common types of interview- Preparing for a job interview - mock Interviews.

UNIT IV **(6 Hours)**

Group Discussion - Aggressiveness and assertiveness - perception in professional communication

UNIT V **(6 Hours)**

Planning for the interview - types of interviews (one to one interview, panel interview telephonic and Skype interview) - interview etiquettes - dress code for interview – frequently asked questions (FAQ).

Total: 30 Hours

Text Books:

1. **How to Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Paul McGee Hachette UK, 2014**
2. **Essentials of Business Communication, Mary Ellen Guffey, Dana Loewy, Cengage Learning, 2012**
3. **Interview Skills that win the job**: Simple techniques for answering all the tough questions, Michael Spiropoulos, Allen & Unwin, 2005

4. **Effective Interviewing and Interrogation Techniques**, William L. Fleisher, Nathan J. Gordon, Academic Press, 2010

References:

1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf
2. http://www.amu.apus.edu/career-services/interviewing/types.htm
3. http://www.careerthinker.com/interviewing/types-of-interview/

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA4PA	Course Name : HYDROSTATICS & STABILITY LABORATORY	L	T	P	C
		0	0	3	1

Year and Semester	II Year & IV Semester		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To perform hydrostatic calculations & Bonjeans, initial stability calculations and surface area calculation 2. Provide the knowledge about IMO requirement for vessel stability.			
Course Outcome	1. Perform various hydrostatic calculations for the given Ship 2. Develop hydrostatic offset with table 3. Develop hydrostatic table using manual calculation 4. Explain initial stability criteria 5. Formulate initial stability calculations 6. Estimate Wetted surface Area and painting surface area.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	1	3	2	1	-	1	2	2
CO2	2	1	1	1	-	-	-	1	3	2	1	-	1	2	2
CO3	2	1	1	1	-	-	-	1	2	2	1	-	1	2	2
CO4	2	1	1	1	-	-	-	1	1	-	-	-	-	-	-
CO5	2	1	1	1	1	-	-	1	1	-	-	-	-	-	-
CO6	2	1	1	1	1	-	-	1	1	-	-	-	-	-	-
AVERAGE	2	1	1	1	1	-	-	1	1.8	2	1	-	1	2	2

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

HYDROSTATIC CALCULATIONS AND CURVES **20 Hrs**

Calculation of hydrostatics particulars and plotting of hydrostatic particulars using software.

STABILITY CALCULATIONS **20 Hrs**

Cross Curves of Stability and GZ curve and IMO criteria check

WETTED SURFACE AREA **5 Hrs**

Wetted surface Area calculation and painting surface area estimation.

Total : 45 Hours

REFERENCES

1. Introduction to Naval Architecture by Eric C Tupper

Principle of Naval Architecture by Edward V Lewis, Vol.1

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering			
Course Code: UDNA4PB	Course Name : Surface Modelling and Analysis - Software Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	II Year & IV Semester	Contact hours per week (2Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To study the surface generation and modelling techniques using appropriate Software. 2. Provide the knowledge about hydrostatics calculation using software.
Course Outcome	1. List various types of ship and different hull forms 2. List various ship curves and its operational uses 3. Explain the working with control points and hydrostatic calculations 4. Examine surface of the given model using appropriate tools available in the Software 5. Develop Hull form hydrostatic curves 6. Estimate the area calculation.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	3	2	1	-	1	1	1
CO2	-	-	-	-	-	-	-	1	3	2	1	-	1	1	1
CO3	-	-	-	2	-	-	-	1	2	2	1	-	1	1	1
CO4	-	-	-	2	-	-	-	1	-	-	-	-	-	1	1
CO5	-	-	2	2	-	-	-	1	-	-	-	-	-	1	1
CO6	-	1	2	2	-	-	-	1	-	-	-	-	-	1	1
AVERAGE	-	1	2	2	-	-	-	1	2.7	2	1	-	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

Introduction to the software and its capabilities, Familiarization with the GUI, entering/importing coordinates for the given vessel, working with the curves, curve types, operations and properties, working with surfaces, surface types and properties, rendering the surface, surface operations, surface creations, trimming and bonding surfaces, working with control points, calculations – Hydrostatics, Girth and Areas.

Total : 30 Hrs

REFERENCES

Software manual

Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER-V

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDBTC02	Course Name : Biology for Engineer	L	T	P	C
		2	0	0	2

Year and Semester	III Year & V Semester		Contact hours per week (2 Hrs)	
Prerequisite course	Any Under Graduate degree with Engineering background			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
	✓			✓

Course Objective

1. To introduce the subject Biology for Engineers as important scientific discipline.
2. To provide fundamental knowledge about classification of living organisms, genetic background, biological molecules, microbiology etc
3. To provide basic knowledge about the application of living organisms in an industry perspective.

Course Outcome

At the end of the course the student will be able to :

1. Outline the structure and characterization of Cell, cell theory and cell cycle.
2. Explain about the law of Mendelian genetics, Genetic code and the transfer of genetic information.
3. Classify on enzymes and principles of energy transactions.
4. Classify the microorganisms and microbial human diseases.
5. Expand the knowledge on industrial application from the biological resources.
6. Elaborate awareness on the importance of biology for engineers.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	1	1	1	-	-	2	2	2	-	1	-	-	-
CO2	-	-	1	1	1	-	-	2	2	2	-	1	-	-	-
CO3	-	-	1	1	1	-	-	2	2	2	-	2	-	-	-
CO4	-	-	1	1	1	-	-	2	2	2	-	2	-	-	-
CO5	-	-	1	1	1	-	-	2	2	2	-	2	-	-	-
CO6	-	-	1	1	1	-	-	2	2	2	-	2	-	-	-
AVERAGE	-	-	1	1	1	-	-	2	2	2	-	1.6	-	-	-

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

Unit I: Introduction and Classification — 6 Hrs

Introduction to Biology, Hierarchy of life forms, Cell – Cell Structure and Function, Cell theory, Cell growth, cell cycle, reproduction and differentiation. Classification, Cellularity, Ultra structure, energy and carbon utilization and Molecular taxonomy.

Unit II: Genetics and Bio molecules — 6 Hrs

Introduction of Genetics, Mendelian Genetics, Genetic code, transfer of genetic information, Genetic disorders, human genetics, Structure and Characterization of Biomolecules Carbohydrates, Protein, lipids, Nucleotides and DNA/RNA

Unit III: Enzymes and Metabolism **6 Hrs**

Introduction to Enzymology, Mechanism of enzyme action, Classification of enzymes, Enzyme catalysis and inhibition, Enzyme kinetics; Principles of energy transactions, Thermodynamics, ATP as source of energy, Glycolysis, Krebs Cycles, Photosynthesis

Unit IV: Microbiology **6 Hrs**

Introduction to Microbiology, Normal flora, Identification and Classification of Microorganisms, Microscopy, Microbial human diseases

Unit V: Biology and Industrial Applications **6 Hrs**

Single cell protein, Bio fertilizer, Biopolymer, Bioremediation, Bio Sensors, Antibiotics and Vaccine, Transgenic plants and animals.

Total Hrs: 30

TEXT BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

REFERENCE BOOKS

1. Biology for Engineers. S.Thyagarajan, N. Selvamurugan, M.P.Rajesh, R.A..Nazeer, Richard.W.Thilagaraj, S. Bharathi and M.K..Jaganathan, Tata McGraw Hill, New Delhi 2012
2. Cell Biology and Genetics (Biology: The unity and diversity of life volume I) Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning 2008
3. Biological Science, N.P.O.green, G.W.Shtout, D.J.Taylor, Cambridge University Press, 1985
4. Industrial Micrology, A.H.Patel, Trinity Press, 2015.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA501	Course Name : STRENGTH OF SHIPS	L	T	P	C
		3	1	0	4

Year and Semester	III Year & V Semester	Contact hours per week (4Hrs)
Prerequisite course	1. Strength of Materials 2. Marine Production technology	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	To understand and evaluate the various loads acting on ship structures and to study ships strength to withstand the applied loads.
Course Outcome	After completion of the course, the students will be able to 1. Estimate of various loads and framing arrangement of ship 2. Experiment with the section modulus and scantling calculations 3. Explain Basics of ship structural analysis 4. Explain various structural design methods 5. Explain various ship structural responses 6. Choose the Various limit states and structural failure modes

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	1	3	1	1	2	-	-	-	2	1	3
CO2	1	2	2	1	1	3	1	1	1	-	-	-	2	2	3
CO3	1	2	-	1	1	-	2	2	1	-	-	2	-	1	1
CO4	3	3	2	2	2	1	2	1	-	-	-	-	1	1	2
CO5	1	1	-	1	1	-	1	1	1	-	-	2	-	1	1
CO6	1	1	-	1	1	-	1	1	1	-	-	2	2	1	1
AVERAGE	2	1.66	1	1	1.3	1.5	2	1.66	1.16	-	-	1	1.16	1.33	1.33
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 – INTRODUCTION TO SHIP STRENGTH 12 Hrs

Structural design concept and philosophy, various forces acting on ship structures in still water and waves: Loads, Weight and Weight distribution, Buoyancy and Buoyancy distribution. Load Curve, shear force curve, bending moment curve, and deflection curve, wave bending curve

UNIT 2 - STRENGTH OF HULL 12 Hrs

Longitudinal strength: Hull as a girder, Hull girder section modulus calculation, Bending stress calculation, Shear stress distribution in cross section, Introduction to shear centre and torsion of hull

UNIT 3 – ANALYSIS OF STRUCTURAL COMPONENTS 12 Hrs

Bulk head analysis, Grillage analysis, stiffened plate panels as open and closed grillage

UNIT 4 - SHIP STRUCTURAL DESIGN CONCEPTS 12 Hrs

Specialization of ship structure, General considerations of external loads, design criteria steps in structural design procedure, design from first principles, structural design according to classification society rules, Working stress design (WSD), Load and resistance factor design (LRFD).

UNIT 5 – ADVANCED METHODS FOR SHIP STRUCTURAL ANALYSIS 12 Hrs

Introduction to finite elements methods, application of finite element method, finite strip method

Total: 60 Hours

TEXT BOOKS

1. Muckle .W Strength of Ships
2. Lewis, E U. Principles of Naval Architecture (2nd Rev) Vol II 1989 SNAME, New York,
3. Taggart R, Ship Design and Construction, SNAME, New York, 1980

REFERENCES

1. Mechanics of Materials, James M. Gere, Stephon P. Temoshenko
2. Ship Construction by D.J.Eyres Merchant Ship Construction by D.A.Taylor
3. Alaa Mansour, Don Liu, Principles of Naval Architecture Series: Strength of ships and ocean structures, SNAME, New Jersey, 2008.
4. Owen. F. Hughes and JeomKee Paik – Ship Structural Analysis and Design, SNAME, New York. 2008.
5. Mohammed Shama – Torsion and Shear Stresses in Ships, Springer - Verlag, 2010.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA502	Course Name : Ship Resistance and Propulsion	L	T	P	C
		3	1	0	4

Year and Semester	III Year & V Semester	Contact hours per week (4Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	To understand the fundamentals of the ships			
Course Outcome	After completion of the course, the students will be able to 1. Define basic knowledge on Fluid and Ship interaction 2. Compare different types of resistance, comparison laws and Model testing of ship 3. Construct ship-model resistance using different methodical series 4. Compare concepts of ship propulsion 5. Explain various types of ship propulsion system. 6. Interpret knowledge in designing of propeller, cavitation's and its calculations.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	-	1	1	1	1	-	1	3	3	3
CO2	1	1	-	1	1	-	1	1	1	1	-	1	3	3	3
CO3	1	3	3	2	2	1	1	1	1	1	-	1	3	3	3
CO4	1	2	1	1	1	-	1	1	1	1	-	1	3	3	3
CO5	1	1	-	1	1	-	2	1	1	1	-	1	3	3	3
CO6	3	3	3	1	2	1	1	1	1	1	-	1	3	3	3
AVERAGE	1.3	2	2	1.16	1.16	1	1.16	1	1	1	-	1	3	3	3
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I-INTRODUCTION 12 Hrs

Basic of fluid mechanics, Laws of Similarity, Froude's Hypothesis, Laminar and turbulent flow, Components of ship resistance

UNIT II-COMPONENTS OF RESISTANCE 12 Hrs

Effect of roughness, Friction lines, Form resistance, Wave resistance, Kelvin wave pattern & wave generated by a ship. Air resistance, Appendage resistance, Resistance prediction methods

UNIT III–DETERMINATION OF RESISTANCE AND POWER 12 Hrs

Estimation of total resistance, Model experiment for resistance estimation of a ship, Estimation of effective power.

UNIT IV–INTRODUCTION TO PROPULSION 12 Hrs

Types of propulsion, Screw propeller geometry, Propeller theories, Circulation theory, Blade elements theory. Laws of Similarity for propellers, Propeller in (open) water, Propeller coefficient and design charts, B_p-S diagrams, K_T– K_Q – J diagrams.

UNIT V – DESIGN OF PROPELLER 12 Hrs

Hull propeller interaction – wake, thrust deduction and relative rotative efficiency; propulsive efficiency and its components; propeller cavitation; propeller blade strength; Propeller design.

Total : 60 Hours

TEXT BOOKS

1. Lewis, E.U.; “Principles of Naval Architecture”, (2nd Rev.), SNAME, New Jersey, U.S.A.
2. Rawson & Tupper; Basic Ship Theory.
3. Tupper, E.C.: Introduction to Naval Architecture, Butterworth- Heinemann, UK, 1998.
4. Ghose,J.P and Gokarn,R.P, "Basic Ship Propulsion", Allied Publishers, 2004
5. Carlton J, Marine Propellers and Propulsion, Elsevier 2007.

REFERENCES

1. Harvald S.A., "Resistance and propulsion of Ships", John Wiley & Son.

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDITC03	Course Name : OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

Year and Semester	III Year & V Semester		Contact hours per week (3 Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		✓		
Course Objective	1. To learn the basic concepts of Object Oriented Programming. 2. To learn the basics of C++ language. 3. To know about C++ functions, classes and objects. 4. To work on identifying the relationship between classes. 5. To define exception and I/O streams			
Course Outcome	After completion of the course, the students will be able to 1. Define object oriented approach to programming and identify potential benefits of object-oriented programming to solve engineering problems 2. Relate real world object into entity. 3. Recall the code and write the classes which work like built-in types 4. Discuss the concept of inheritance. 5. Design applications which are easier to debug and maintain 6. Discuss object oriented concepts in real world applications			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	1	-	-	1	-	-	-	-	-	-	-
CO2	3	2	2	2	1	-	-	1	-	-	-	-	-	-	-
CO3	2	3	2	-	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	3	3	2	-	-	1	-	-	-	-	-	-	-
CO5	3	2	1	1	1	-	-	1	-	-	-	-	-	-	-
CO6	3	3	3	3	3	-	-	1	-	-	-	-	-	-	-
AVERAGE	2.3	1.8	1.8	1.8	1.3	-	-	1	-	-	-	-	-	-	-

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNITI-INTRODUCTION TO OBJECT ORIENTED PROGRAMMING WITH C++ 9 Hours

Principles of Object Oriented Programming (OOP),Basic concepts of OOP - Advantages of OOP - Applications of OOP - Introduction to C++, Tokens, Keywords, Identifiers, data types, Input/output functions, variables, References, Operators, Expressions.

UNIT II-CONTROL STRUCTURES AND FUNCTIONS 9 Hours

Control Structures: if – if else - nested if – else if ladder - switch case - Repetitive Statements – for – while - do while, Pointers and arrays, Functions in C++ - Main Function - Function Prototyping – Parameters Passing in Functions - Values Return by Functions - inline Functions - Function Overloading.

UNIT III -CLASSES AND OBJECTS 9 Hours

Classes and Objects, friend function, Constructors and Destructors - Type of Constructors – Default constructor - Parameterized constructor - Copy constructor, Operator Overloading – Unary operator overloading – Binary operator overloading.

UNIT IV -INHERITANCE AND POLYMORPHISM 9 Hours

Inheritance: Access specifiers - Single Inheritance - Multiple inheritances - Multilevel inheritance - Hierarchical Inheritance -Hybrid Inheritance, Polymorphism – Virtual Functions, pure virtual function, Abstract Class.

UNIT V-FILES AND EXCEPTION HANDLING **9 Hours**

Working with Files: Classes for File Stream Operations –File pointer - Opening and Closing a File - End-of-File detection –Exception handling: Need of Exceptions – keywords - Simple and Multiple Exceptions.

TOTAL :45 Hours

TEXTBOOKS:

1. Paul J Deitel, Harvey M. Deitel, "C++ How to program", eight edition, Pearson, 2011.
2. E. Balaguruswamy, "Object Oriented Programming with C++", Seventh Edition, Tata McGraw-Hill, 2017.

REFERENCES:

1. Herbert Schildt, "C++: The Complete Reference", Tata McGraw publication, 2003.

Ashok N.Kamthane, "Object Oriented Programming with ANSI & Turbo C ++", First Edition, Pearson Education, 2012.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE - Naval Architecture & Offshore Engineering				
Course Code UDNAP01	Course Name: NUMERICAL ANALYSIS AND PROGRAMMING	L	T	P	C
		3	0	0	3

Year and Semester	III Year & V Semester	Contact hours per week (3 Hrs)		
Prerequisite course	ENGG. MATHEMATICS			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	Students understand the basis of numerical methods and programming in engineering applications.	
Instructional objectives of the course	Students will be able to	
	1	List the inherent deficits of the numerical and programming errors.
	2	Explain the various methods to solve the algebraic equations.
	3	Develop an understanding of curve fitting and interpolation in engineering applications.
	4	Analyze the various methods of numerical differentiation and its applications.
	5	Assess the various methods of numerical integration and its applications.
	6	Improve the overall knowledge of numerical applications and programming.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	1	2	-	1	-	1	1	-	1	-
CO2	1	1	-	-	1	1	2	-	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
CO4	1	1	-	-	-	-	1	2	1	1	1	1	1	1	1
CO5	1	1	-	1	-	1	1	2	1	1	1	1	1	1	1
CO6	1	1	-	-	1	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	1	1	1	1	1.6	1.7	1	1	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – ERROR ANALYSIS 9 Hrs

Types of errors, Propagation of errors, Correct and Significant digits, Examples and exercises. Programming: Basic commands of C++.

UNIT II – SOLUTION OF SYSTEM OF LINEAR ALGEBRAIC EQUATIONS 9 Hrs

Exact methods: LU-decomposition, Gauss-elimination methods without and with partial pivoting.

Iterative methods: Gauss-Jacobi and Gauss-Seidal methods, Matrix norm, Condition number and ill – conditioning. Programming: Gauss – Siedel iteration method.

UNIT III – CURVE FITTING & INTERPOLATION 9 Hrs

Curve fitting – linear and nonlinear regression analysis.

Interpolation Formulae: Newton's forward, backward, Newton's divided difference and Lagrange's formulae, Errors in various interpolation formulae. Programming: Error calculation.

UNIT IV – NUMERICAL DIFFERENTIATION 9 Hrs

Various formulae for first and second derivative with errors, Examples and Exercises. Programming: Comparison of different methods.

UNIT V – NUMERICAL INTEGRATION **9 Hrs**

Newton-Cotes formulae, General quadrature formula for equidistant ordinates, Trapezoidal, Simpson's 1/3 and 3/8 rules with their geometrical interpretations and errors, Romberg integration and Gaussian quadrature formulae, Examples and Exercises. Programming: Comparison of different methods.

Total Hrs: 45

TEXT BOOKS:

4. Shastry, S.S., Numerical Methods, Prentice Hall Inc., India, 1998.
5. Noble Ben, Numerical Methods, New York International Publications, New York, 1964.
6. Stanton Ralph G., Numerical Methods for Engineering, Englewood cliffs, N.J., Prentice Hall Inc., 1961.
7. Buckingham R.A., Numerical Methods, Sir Isaac Pitman Sons. Ltd., London, 1957.

REFERENCES:

4. James Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co. Pvt. Ltd (1950), ISBN 10: 0009780021, ISBN-13:978-0009780021.
5. M. K. Jain, SRK Iyengar and R.K. Jain, Numerical Methods For Scientific & Engg. 5e, New Age International (P) Ltd (2008), ISBN-13:978-8122420012.
6. C.F. Gerald and O.P. Wheatley, Applied Numerical Analysis, Addison Wesley; 7 edition (2003), ISBN-13:978-0321133045.
7. NPTEL lectures: Numerical Analysis and Computer Programming (video): Web Address: http://nptel.ac.in/courses/122106033/
8. NPTEL lectures: Numerical Analysis (Web): Web Address: http://nptel.ac.in/courses/111107062/

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP02	Course Name : Wave mechanics	L	T	P	C
		3	0	0	3

Year and Semester	III Year & V Semester	Contact hours per week (3Hrs)	
Prerequisite course	NIL		

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand the motion characteristics in waves and to evaluate the steering features of surface ships in calm waters*	
Instructional objective of the course	Students will be able to	
	1	Defines a basic knowledge regarding mechanics of water waves
	2	Explain concepts behind wave kinematics using linear wave theory and its application in Naval Architecture and Offshore Engineering
	3	Identify the fundamental understanding of water waves and to apply the basic physical principles to the ocean and coastal environments.
	4	Classify finite amplitude waves and its theories
	5	Assess the wave deformations and Define real sea state and wave loads
	6	Elaborate the concepts behind wave kinematics using wave theories and its application in Naval Architecture and Offshore Engineering

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO2	1	1	-	-	-	-	1	-	-	-	-	1	1	1	-
CO3	1	1	-	-	1	1	1	1	-	1	1	1	1	1	1
CO4	1	1	2	2	1	2	2	1	1	1	1	1	1	1	1
CO5	1	1	-	2	1	2	2	1	1	2	1	1	1	1	1
CO6	1	-	2	2	-	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	2	2	1	1.5	1.6	1.2	1	1.2	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – WATER WAVES **9 Hrs**

Fluid mechanics basics, Wave s- Definition of wave parameters, classification of water waves, the sinusoidal wave profile, some useful functions and numerical methods, Two dimensional wave equation and wave characteristics, Introduction to Wave theories

UNIT II – SMALL AMPLITUDE WAVES **9 Hrs**

Velocity potential, wave dispersion ,wave table ,water particle kinematics, water particle, displacements ,group celerity, wave energy and power, Sub surface pressure

UNIT III -: FINITE AMPLITUDE WAVES **9 Hrs**

Non linear waves –Wave steepness, Non linear wave theory - Stoke's wave theory , Cnoidal wave theory, Solitary wave theory, Stream function wave theory ,validity of wave theories

UNIT IV – WAVE DEFORMATIONS AND CURRENTS **9 Hrs**

Wave deformation – Wave Refraction , Wave diffraction , Reflection , and breaking of Waves. Water Currents, Classification , Wave current interaction , effects of currents

UNIT V – IRREGULAR WAVES AND FORCES **9 Hrs**

Irregular waves- Introduction , ocean wave analysis methods , spectral method ,statistical methods and parameters ,sea state, Wave forces: – Morison equation – Wave load on vertical, inclined and horizontal cylinders, Diffraction theory – Wave slamming and slapping

Total : 45 Hrs

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP03	Course Name : LIFTING SURFACES FOR MARINE APPLICATIONS	L	T	P	C
		3	0	0	3

Year and Semester	III Year & V Semester	Contact hours per week (3Hrs)		
Prerequisite course	Marine Hydrodynamics			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand the Importance of the lifting surface design and its marine applications*	
Instructional objective of the course	At the end of the course the students should be able to	
	1	Tell the importance of fluid mechanics in lifting surface design
	2	Demonstrate the concepts of hydrodynamics in developing the control surfaces
	3	Model the propeller design for the given vessel
	4	Classify different types of rudders and their applications
	5	Influence of rudder design for the given vessel
	6	Improve the understand of concepts involved in the design procedure for fins and hydroplanes

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	2	2	2	1	1	1	1	-	-	1	1
CO2	-	-	-	-	1	1	1	1	1	1	1	-	-	1	1
CO3	-	-	-	-	-	-	-	2	2	1	1	-	-	2	2
CO4	1	1	2	1	2	2	2	1	2	2	1	2	2	2	1
CO5	1	1	2	-	2	2	2	2	1	2	1	1	1	2	1
CO6	-	1	2	1	1	2	2	1	2	2	-	2	2	2	1
AVERAGE	1	1	1.7	1	1.6	1.8	1.8	1.3	1.5	1.5	1	1.6	1.6	1.6	1.1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – HYDRODYNAMIC CONCEPTS **9 Hrs**

Recapitulation of concepts in Marine Hydrodynamics – Uniform flow, Streamlines, pressure velocity changes in a moving fluid, stagnation point, vortex flow, Reynold's number, boundary layer, flow separation

UNIT II – LIFTING SURFACES FOR MARINE APPLICATIONS **9 Hrs**

Lifting foils and its properties, Geometry of a lifting foil; Induced drag – Aero foils of infinite and finite span, different types of lifting surfaces for marine applications – fixed and movable, Lift and drag, Lifting line theory

UNIT III – PROPELLER **9 Hrs**

Concepts of conformal mapping, propeller geometry, actuator disk, propeller lifting line theory, potential flow around a circle, Kutta condition, vortex lines, vortex lattice method, cavitation, propeller design procedure, *Project – Design of propeller for the given vessel*

UNIT IV – RUDDER **9 Hrs**

Rudder types, rudder action, single screw and twin screw arrangements, rudder-propeller interaction, influence of hull on rudder-propeller performance, rudder design strategy, hydrodynamics characteristics, Free surface effects – rudder submerged condition, surface piercing condition, cavitation, high-lift rudders

Project – Design of rudder for the given vessel

UNIT V – OTHER LIFTING SURFACES **9 Hrs**

Fin stabilizers – applications, design procedure, section design, cavitation, operation, roll stabilization; Hydroplanes – applications, design procedure and data, operation; Pitch damping fins – applications, design procedure and data, operations

Total Hrs: 45

TEXT BOOKS

1. **Anthony F Molland and Stephen R Turnock,** *Marine Rudders and Control Surfaces - Principles, Data, Design and Applications***,** Elsevier, 2007
2. ***Lewis, E.V.****Principles of Naval Architecture - Vol III Motions in Waves and Controllability*, 2nd edition, The Society of Naval Architecture and Marine Engineers, Jersy City, NJ, 1989
3. **R.K Bansal,***A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 2008
4. **Volker Bertram,***Practical Ship Hydrodynamics*, Butterworth – Heinemann, 2000

REFERENCES

5. **Abbott, I.H. and Doenhoff, A.E.V.***Theory of wing sections*, New York: Dover publications, 1958.
6. S.K Som, Gautham Biswas, S Chakraborty, *Introduction to Fluid Mechanics and Fluid Machines*, Mc Graw Hill, 2011
7. **Perez, T.***Ship Motion Control - Course keeping and roll stabilization using rudder and fins*, Springer-Verlag London Limited, 2005.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE - Naval Architecture & Offshore Engineering				
Course Code	Course Name:	L	T	P	C
UDNAO03	OCEAN ENERGY	3	0	0	3

Year and Semester	III Year (SEMESTER V)	Contact hours per week	
Prerequisite course	NIL	(3 Hrs)	

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	Students formulate the knowledge on variety of available ocean energy resources and statutory requirements.
Instructional objectives of the course	Students will be able to
1	List the available resources of ocean energy worldwide.
2	Illustrate the wave energy system design.
3	Organise the various design aspects of tidal and current energy system.
4	Classify the necessity of thermal & osmotic energy system design.
5	Evaluate the various economics and policies of the state/country to support the ocean energy development.
6	Adapt the ocean energy into the development of energy systems.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	-	-	1	-	-	-	-	-
CO2	1	1	2	1	-	1	1	-	1	-	-	1	1	2	1
CO3	1	1	2	2	-	1	1	-	1	-	-	1	1	2	1
CO4	1	1	2	1	-	1	1	-	1	-	-	1	1	2	1
CO5	-	-	-	-	2	-	1	-	2	2	1	2	1	1	2
CO6	-	1	1	1	-	1	2	2	1	-	1	2	1	2	2
AVERAGE		1	1.7	1.2	2	1.5	1.3	2	1.2	1.5	1	1.4	1	1.8	1.4
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I – OCEAN ENERGY RESOURCES 9 Hrs

Introduction to ocean environment – ocean circulation and stratification, ocean habitat, ocean economy; Various ocean energy resources worldwide; Site selection and characterization; Present development and future need; Energy routes.

UNIT II – WAVE ENERGY 9 Hrs

Ocean surface waves – wave measurements, wave theories, existing resources in India; System working principle; Various design concept, design challenges; Case study – reliability of the design and lifespan.

UNIT III – TIDAL & CURRENT ENERGY 9 Hrs

Current measurements, current turbulence and energy resources; Existing resources in India, working principle; Various design concept, design challenges; Material selection; Case study – future requirement and any existing design.

UNIT IV – THERMAL & OSMOTIC ENERGY 9 Hrs

Introduction – Existing resources in India, working principle; Various design concept, design challenges; Case study – efficiency calculation of various system components.

UNIT V – ECONOMICS, POLICY AND ENVIRONMENT 9 Hrs

Basic economic analysis of ocean energy systems – cost and financing; Policy issues regarding ocean energy system in India – Socio-economic impact, licensing and permitting procedures; Environmental impact; Case study – any existing ocean energy system.

Total 45 hrs

TEXT BOOKS:

8. Sørensen, Bent. Renewable Energy, Second Edition. San Diego: Academic Press, 2000, 911 pp. ISBN 0-12-656152-4.
9. Vining, J., Muetze, G. A., Economic Factors and Incentives for Ocean Wave Energy Conversion.
10. Karimirad, Madjid, Offshore Energy Structures - For Wind Power, Wave Energy and Hybrid Marine Platforms, Springer International Publishing, Switzerland, 2014.
11. Markian M. W. Melnyk, Robert M. Andersen, Offshore Power: Building Renewable Energy Projects in U.S. Waters, PennWell Books, 2009.
12. Iea-Retd (Stichting Foundation Renewable), Offshore Renewable Energy: Accelerating the Deployment of Offshore Wind, Tidal, and Wave Technologies, Routledge, 2012.

REFERENCES:

9. J W Twidell & A D Weir, Renewable Energy Resources, ELBS, 2006.
10. Vining, J., Muetze, G. A., Economic and Legal aspects of Ocean Wave Energy Conversion, EC 999: Advanced Independent Study Report, May 2006.
11. Bent Sorensen, Renewable Energy, Elsevier, Academic Press, 2011.
12. NPTEL lectures: Elements of Ocean Engineering (video): Web Address: http://nptel.ac.in/syllabus/114105002/

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAO04	QUALITY HEALTH SAFETY AND ENVIRONMENTAL MANAGEMENT	3	0	0	3

Year and Semester	III Year (SEMESTER V)	Contact hours per week		
Prerequisite course	NIL	(3Hrs)		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	*To understand the importance of the quality control, assurance and management system in ship building and to learn the necessity of ISO*	
Instructional objective of the course	Students will be able to	
	1	Define different quality concepts
	2	Demonstrate QA & QC in Ship Building
	3	Organize the different Environmental management systems and Occupational Health and Safety Series System
	4	Classify the importance of ISM codes
	5	Importance of ISO 9000 quality management system, ISO 14000 & OHSAS 18000.
	6	Adapt the quality measures in shipping industry

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	2	-	2	-	2	-	-	1	1	-	1	-
CO2	-	1	-	2	1	2	-	2	-	-	1	1	1	2	2
CO3	-	-	2	1	1	2	2	2	2	2	2	2	1	2	2
CO4	-	-	-	1	-	-	-	2	-	-	1	2	1	1	-
CO5	-	-	-	1	-	2	-	2	-	-	2	2	1	1	-
CO6	-	1	1	2	1	2	1	2	-	2	2	2	2	2	2
AVERAGE	-	1	1.5	1.5	1	2	1.5	2	2	2	1.5	1.6	1.2	1.5	2
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO QUALITY CONCEPTS 9 Hrs

Definitions of Quality, Quality control, Quality Assurance, Quality Management, Quality Management system, Total Quality Management (TQM).Four principles of TQM, Quality costs, Quality statements- Vision, Mission, Quality policy, Quality Objectives and Targets.

UNIT II - APPLICATION OF QA & QC IN SHIP BUILDING INDUSTRY 9 Hrs

Identification of customer requirements, QA/QC Documentation requirements, Quality Planning, skilled Labour, Competency/Training and Awareness; Design and Development; control on vendors and purchased products, operational control including control on welding processes; monitoring and measurement of processes, inspection and testing on

- Raw material, in-process and final product;
- Pre-delivery inspection including Dry surveys I & II, Different methods of NDT Testing; Dock trials and sea Trials

UNIT III - ISO 9000 QUALITY MANAGEMENT SYSTEM 9 Hrs

Need for ISO 9000 Quality Management system and Description of its elements, Major steps in achieving ISO 9000 certification – Awareness / Training, Documentation, Implementation Internal Audit, Audit methodology and auditor qualities External certification audit, Certification and annual verification audits, Quality awards – international quality awards and National quality awards

UNIT IV - INTRODUCTION TO ISO 14000 & OHSAS 18000 **9 Hrs**

Introduction to the basic concepts of

a) Environmental management system (ISO 14001:2004 EMS)
b) Occupational Health and safety series system (OHSAS 18001:2007).

Environmental aspects and impact assessment in and determining controls in EMS, Hazard identification and risk assessment and determining controls in OHSAS, Operational control and Emergency Preparedness and Response (common to both EMS and OHSAS), Performance measurement including audit and management review and external certification. (Common to both EMS and OHSAS)

UNIT V - INTRODUCTION TO ISM CODE **9 Hrs**

ISM code (international safety management for safe operation of ships and for pollution prevention), Introduction to ISM code -Background and purpose, Documentation, planning for shipboard operations and implementation of operations including emergency preparedness and Response, Audit and certification (Interim and final).Certification of Both DOC (Document of compliance for company) and SMC (Safety Management certificate for ship); Periodical verification of the maintenance of ISM code

Total 45 hrs

TEXT BOOKS

1. Total Quality Management by Dale. H.Besterfield and Others – PEARSON Education Inc (Indian Reprint – 2010)
2. Total Quality Management by Dr. D.D.Sharma. Sultan chand and sons New Delhi (Reprint 2005).
3. Implementing ISO 9000 QMS by pradeepkumar. Mathur – Vikas publishing House, New Delhi
4. A Text Book of Total Quality Management (for B.E.,/ B.Tech VIII semester Anna University) By Prof. R.Ramakrishnan by Dhanam publications – Chennai

REFERENCES

1. International standard ISO 9001 Quality Management system –Requirements ISO 9001:2008(E) – Bureau of Indian standards Publications-Chennai
2. IS/ISO 14001: 2004 – Environmental management system – Requirements with Guidance for use – Bureau of Indian standards – Chennai
3. Occupational health and safety managements- Requirements (OHSAS 18001:2007) – Bureau of Indian standards publications – Chennai
4. International standard ISO 19011: 2011 – Guide lines for Auditing Management systems – Bureau of Indian standards Publications, Chennai
5. ISM code - Amended up to 2010 (IMO Publication, London).

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering			
Course Code: UDITCPB	Course Name : OBJECT ORIENTED PROGRAMMING LAB	L	T	P	C
		0	0	2	1

Year and Semester	III Year (semester V)	Contact hours per week (2 Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
		✓		

Course Objective	1. To get clear understanding of object-oriented concepts 2. To understand object oriented programming through C++ To get familiarized in file operations
Course Outcome	After completion of the course, the students will be able 1. Define basics of programming language. 2. Inspect object oriented concepts. 3. Determine the significance of constructor and destructor. 4. Determine file handling operations. 5. Determine the ways to test and debug errors. 6. Distinguish the features of object oriented concepts to solve real world problems.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	2	2	-	-	-	-	-	-	-	-	-	-
CO6	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
AVERAGE	2.1	2	2.4	2.2	2.2	-	-	-	-	-	-	-	-	-	-

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

1. Simple C++ programs to implement various control structures.
2. Programs to implement the concept of classes and objects.
3. Programs to implement the concept of arrays of object.
4. Programs to understand function overloading
5. Program to implement operator overloading
6. Program to implement Constructor and destructor
7. Programs to implement the concept of inheritance
8. Programs to understand friend function and friend class
9. Programs to handle the error using exception handling
10. Programs to perform file operation.
11. Exercises applying on the relevant discipline.

TOTAL: 30 HOURS

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA5PA	Course Name : SHIP STRENGTH LABORATORY	L	T	P	C
		0	0	2	1

Year and Semester	III Year (semester V)	Contact hours per week (4Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	To perform the General Arrangement and Strength of the Ship
Course Outcome	After completion of the course, the students will be able to 1. Develop General arrangement of ship. 2. Evaluate the longitudinal strength of ship and weight. 3. Explain various ship strength 4. Construct a Mid ship and find section modulus 5. Criticize the concepts of sheer force and bending moment 6. Estimate Mid ship Scantling calculation.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	1	1	-	-	-	-	3	3	3
CO2	3	2	3	1	-	-	1	1	-	-	-	-	3	3	3
CO3	-	1	3	2	2	-	3	1	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
AVERAGE	2	1.6	3	1	1.5	-	2	1					3	3	3

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

GENERAL ARRANGEMENT OF SHIP

- General arrangement of ship as per the classification society rules and other rules
- Drawing in CAD Software: Arrangement of cargo holds
- Arrangement of Engine Room
- Capacity calculations
- Arrangement of Tank plan
- Arrangement of accommodation
- Arrangement of Superstructure

LONGITUDINAL SHIP STRENGTH

Ship in calm water, wave bending, stresses due to bending. Weight curve, buoyancy curve, shear force & bending moment calculations and diagram.

SCANTLING

Scantling calculations and Drawing of Mid ship Section , Section Modulus Calculations of the ship as per Classification Rules

Total : 30 Hours

REFERENCES

1. Classification Rules
2. Principle of Naval Architecture by Edward V Lewis
3. Robert Taggard, Ship Design & Construction

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA5PB	Course Name : STRUCTURAL MODELLING-SOFTWARE LABORATORY	L	T	P	C
		0	0	2	1

Year and Semester	III Year (semester V)		Contact hours per week (2Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	To perform the General Arrangement and Strength of the Ship			
Course Outcome	After completion of the course, the students will be able to 1. List the background of the software. 2. Develop General arrangement of ship. 3. Develop a mid-ship section of the ship using software. 4. Evaluate the longitudinal strength of ship and weight. 5. List ship structural terminology. 6. Compose Mid-ship Scantling calculation.			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	1	1	1	1	-	-	3	3	3
CO2	3	1	3	2	2	1	3	1	-	-	-	-	3	3	3
CO3	3	1	3	2	2	1	3	1	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	1	-	-	-	-	3	3	3
AVERAGE	2.3	1.3	3	1.6	1.6	1	1.66	1	1	1	-	-	3	3	3

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

- **Primitive creation** – plane, block, pyramid, cylinder, cone, sphere, toroids.
- **Curved surface creation** – swept extruded, rotated, skinned surfaces, 3 or 4 boundary interpolated patches, tube.
- **Curve primitives** – polylines, splines, lines, arc, ellipse, NACA sections.
- **Surface operations** – subtract, unite solid intersection, intersect, imprint, join, combine, blend, scale, move, rotate, align, reflect, copy, concatenate, and control point editing.
- **2D operations** – join; trim, cross, offset, fillet.
- **Visualization** – principal curvature, curvature tufts, Gaussian, isophotes, transparency, lights. Interactive point and curve editing
- Automatic curve fairing and data reduction
- Hull form hydrostatics
- Lines plans and loft books
- Compartmentation
- Structural Strength in different loading condition

Total : 30 Hours

REFERENCES

1.Software manual

2.Robert Taggard, Ship Design & Construction

3.Principle of Naval Architecture by Edward V Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"				
PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA5PC	Course Name : Internship - I	L	T	P	C
		0	0	0	1
Year and Semester	III Year (semester V)		Contact hours per week (N/A)		
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. Comprehending the classroom learning by practicing real time in industry. Learning how things could be executed within time.				
Course Outcome	After completion of the course, the students will be able to: 1. Create correlation between what is taught during the classes and the industry practices. 2. Explain procedural aspects of the project being undertaken in the industry. 3. Explain the experience of their own. 4. Explain the importance of the stay/work in the industry. 5. Compare gained in the classroom-based learning to fulfill the tasks given during the internship. 6. Improve the classroom based learning through the internship experience.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO2	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO3	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
AVERAGE	-	-	-	-	-	-	-	2	-	-	-	-	2.5	2.5	2.5

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

A student must undergo an internship for a minimum period as prescribed by the department in the relevant field of Naval Architecture or Offshore Engineering.

Total: N/A

TEXTBOOKS: N/A
(not limited to any topics)

REFERENCES: N/A
(not limited to any topics)

Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER-VI

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA601	Course Name : DESIGN OF OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

Year and Semester	III Year (VI semester)		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objective	1. To understand the principle involved in the design procedure of offshore structures 2. To understand and evaluate static and dynamic loads on the offshore structures using standard rules. 3. To design floating and fixed offshore structures and design of submarine pipelines			
Course Outcome	After completion of the course, the students will be able to 1. Summarize design of an offshore platform. 2. Estimate punching shear and joint capacity calculations including fatigue analysis. 3. Design structure against accidental loading. 4. Analyse the stability of submarine pipelines. 5. Design of floating structures and semi floating structures. 6. Design an offshore structure			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	1	1	2	1	1	2	2	2	2	2	2
CO2	2	2	2	-	2	1	1	1	1	2	-	2	2	2	2
CO3	2	2	3	-	2	1	1	2	1	1	-	2	2	2	2
CO4	2	2	3	-	2	2	1	2	2	1	-	2	2	2	2
CO5	2	3	2	1	2	1	1	2	1	2	2	2	2	2	2
CO6	2	3	2	1	2	1	2	2	2	2	2	2	2	2	2
AVERAGE	1.8	2.1	2.3	1	1.8	1.3	1.3	1.16	1.3	1.6	2	2.0	2.0	2.0	2.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I-DESIGN PRINCIPLES AND METHODS 10 Hours

Introduction - Types of offshore structures and structural components, Planning of Offshore Structures; Design criteria and procedures, Design requirements. Loads on offshore structures, Static and dynamic loads - Wind Loads, Wave loads – Morison equation, Current Load. Design methods and Principles of Steel Tubular Members.

UNIT II – DESIGN FOR STATIC AND DYNAMIC LOADS

Design of jacket structure against static loading - Allowable stresses and Partial Safety Factors; Design for combined stresses- as per API RP 2A guidelines. Design for Cyclic Loads- Design Wave approach. Simple tubular joints, design using allowable loads; Fatigue -stress concentration factors; S-N curves and fatigue damage calculations.

UNIT III-DESIGN FOR ACCIDENT ALLOADING 8 Hours

Design against accidental loading (Fire, blast and collision), Plastic design method, Lifting and Transportation analysis, Redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift.

UNIT IV-DESIGN OF SUBMARINE PIPELINES **5 Hours**

Design of submarine pipe line and Risers, Route selection and Diameter / wall thickness calculations; Pipeline stability, free span calculations; Concrete coated pipelines and pipe-in-pipe insulated pipelines.

UNIT V- DESIGN OF FLOATING STRUCTURES **12 Hours**

Design criteria, Column stabilized structures; design of pontoons; Tension leg platforms; Tethers selection and design; Spar hulls; classic, truss and cell spar; Spar hull compartments and design of shell structures; offshore wind turbine support structures. Overview on decommissioning of offshore platforms.

Case Study : 1.Case Study on Failures of offshore structure

Assignment : 2**.** Numerical modeling and analysis of offshore structure

Total :45 Hours

TEXT BOOKS

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
2. API RP 2A. Planning, Designing and Constructing Fixed Offshore Platforms, API.
3. McClelland, B &Reifel, M. D., Planning & Design of fixed Offshore Platforms, VanNostrand, 1986.
4. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
5. Reddy, D. V &Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ.Co.1991.
6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
7. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.

REFERENCE BOOKS

1. Hand book of Offshore Engineering – S.K. Chakrabarti, Elsevier Publications 2005.
2. API RP 2A(WSD or ASD)
3. API RP 2A (LRFD)
4. Offshore structures design , construction and Maintenance by Mohamed A. EI-Reedy

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code:	Course Name :	L	T	P	C
UDNA602	SHIP MOTIONS AND CONTROL	3	1	0	4

Year and Semester	III Year (VI semester)		Contact hours per week (4Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1.To understand the motion characteristics in waves 2. To evaluate the steering features of surface ships in calm waters 3. To analyses the performance of floating vessels
Course Outcome	After completion of the course, the students will be able to 1. Evaluate analytically the Sea keeping analysis for 1-DOF. 2. Estimate the ship response spectrum in random waves. 3. Estimate the control fixed stability of surface ships. 4. Interpret behaviour of linear hydrodynamic derivatives in manoeuvring. 5. Examine standard manoeuvres and experiments for determining the hydrodynamic derivatives. 6. Discuss the hydrodynamics associated with rudder selection and its design aspect.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	2	2	3	2	1	2	2	2	-	-	2	2
CO2	2	2	2	2	2	1	-	-	2	2	2	-	2	2	2
CO3	2	2	2	2	2	1	-	-	2	2	2	-	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2	-	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO6	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
AVERAGE	1.16	2.0	2.0	2.0	2.0	1.6	2.0	1.75	2.0	2.0	2.0	2.0	2.0	2.0	2.0

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I – MARINE ENVIRONMENT **12 Hrs**

Regular surface waves and their properties, Irregular Waves – statistical representation, Sea State spectrum, Beaufort scale. Introduction to sea keeping, Ship in waves, Frequency of encounter

UNIT II – MOTION CHARACTERISTICS IN REGULAR WAVES **12 Hrs**

Ship motions in regular waves – Heave, Pitch and Roll - Equations of motion (uncoupled), Dynamic response curve, Determination of hydrodynamic coefficients using Strip theory – added mass and damping coefficients, coupled motions – heave and pitch

UNIT III -MOTION CHARACTERISTICS IN IRREGULAR WAVES AND DYNAMIC EFFECTS 12 Hrs

Ship motions in irregular waves, Response spectra, Dynamic effects; deck wetness, slamming, relative motions, motion sickness, Added resistance and loss of ship speed in seaway, Polar diagram, Design considerations for sea keeping, Motion stabilizers.

UNIT IV – MANEUVERING CHARACTERISTICS OF SURFACE SHIP **12 Hrs**

Introduction to maneuverability, Types of directional stability, linear equations of motions in horizontal plane, hydrodynamic and control derivatives, stability index, standard maneuvers; turning circle, zigzag, pull-out and spiral maneuvers, heel during turn

UNIT V – MANEUVERING STANDARDS AND RUDDER CHARACTERISTICS 12 Hrs

Experimental determination of hydrodynamic derivatives; straight-line, rotating arm and PMM experiments, IMO Guidelines, Estimation of maneuverability in ship design, standards for ship maneuverability, Maneuvering in shallow water; Squat, Bank Cushion effect, Interaction between ships**,** Control surface – Rudder and their types.

Total : 60 Hours

TEXT BOOKS

1. Dynamics of Marine Vehicles, R Bhattacharya, 1978
2. Principles of Naval Architecture, Vol III, edited by Edward V Lewis
3. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.

REFERENCES

1. Introduction in Ship Hydrodynamics, by J M J Journee & Jacob Pinkster, Delft University of Technology
2. Sea keeping : Ship Behavior in Rough Weather , by A R J M Lloyd

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA603	Course Name : SHIP DESIGN	L	T	P	C
		3	1	0	4

Year and Semester	III Year (VI semester)		Contact hours per week (4Hrs)	
Prerequisite course	1. Ship Theory Ship Resistance and Propulsion			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. To understand the ship design process for ship hull form design. 2. To apply the various steps involved in the various process for ship hull for Design. 3. To evaluate design problems and evaluate the overall design.
Course Outcome	After completion of the course, the students will be able to 1. Define the concept of ship design as an overview 2. Explain the criteria for selection of various hull form requirements for different ship types 3. Develop lines plan and general arrangement requirements and solve problems 4. Discuss the optimization of existing ship with numerical approach 5.Select stem and stern hull forms 6.Design procedures and practice for estimating principal dimensions, hull form parameters, lightships and deadweight components

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	1	1	1	1	1	1	-	2	2	3	2
CO2	2	2	2	-	2	1	1	1	1	1	-	2	2	3	2
CO3	2	2	3	-	2	1	1	1	1	1	-	2	2	3	2
CO4	2	2	3	-	2	1	1	1	1	1	-	2	2	3	2
CO5	2	3	2	1	2	1	1	1	1	1	-	2	2	3	2
CO6	2	3	2	1	2	1	1	1	1	1	-	2	2	3	2
AVERAGE	1.8	2.1	2.3	1	1.8	1	1	1	1	1	-	2.0	2.0	3	2.0
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I - DESIGN PHILOSOPHY **12 Hours**

Ship design as a science and as an art; Manufacturing and operational considerations in Ship design, Technological and economical factors, National and Global priorities.

UNIT II - DESIGN CONSIDERATION OF SHIPS **12 Hours**

Owner's requirements, Technical specification and ship building contract procedures, shipyard production facilities and operational constraints to be considered in the design process, Ship design method using basis ship, design spiral.

UNIT III –SELECTION OF DIMENSIONS AND COEFFICIENTS **12 Hours**

Selection of main dimensions -Initial Sizing, Selection of Hull Form Coefficients, Determination of the main dimensions – Methods, Rationalization of dimensions

UNIT IV – DESIGN OF HULL FORMS **12 Hours**

Sectional Area Curve and factors affecting sectional area curve, Section Shape, midship section, Stem and Stern profiles, Types of bow, bulbous bow, parabolic bow, Form of stern; Elliptical, Cruiser Stern , Transom Stern, Hull forms of ships (Bulk Carrier, Tanker, Container ships, etc)

UNIT V – GENERAL ARRANGEMENT AND DISPOSITION OF WEIGHTS 12 Hours

Preliminary General arrangement, calculations of weight, volume and capacity using empirical formulae

Total - 60 Hours

TEXT BOOKS

5. Ship Design Methodologies of Preliminary Design by ApostolosPapanikolaou
6. Practical Ship Design by D.G.M Watson
7. Ship Design for Efficiency and EconomybyH. Schneekluth and V. Bertram
8. Ship Design and Construction by R.Taggart.

REFERENCES

3. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
4. Principles of Naval Architecture, Vol. 1, 2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UDNAP04	Course Name : CAD/CAM IN SHIPBUILDING	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objectives	The course introduces to the mathematics and programming implementation of geometric design, required to generate smooth and fair curves, surfaces and volumes for marine applications (form design)			
Course Outcome	At the end of the course the students should be able to			
	1	Relate the mathematical interpretation around computer graphic.		
	2	Explain the techniques used in fairing a curve design for ship		
	3	Develop to create program for the mathematical equations of curve		
	4	Examine the variable in different curves and difference of constraints		
	5	Evaluate the numerical coding techniques understood by conventional machines		
	6	Adapt the context in mathematical program behind a computer program		

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	1	1	1	-	-	-	-	-	-	1	1
CO2	-	1	-	1	1	1	1	-	-	-	-	-	-	1	1
CO3	-	1	-	-	1	1	1	1	1	1	-	1	1	1	1
CO4	-	1	-	1	1	1	1	1	-	-	1	1	1	1	1
CO5	-	1	-	1	1	1	1	1	-	-	1	1	1	1	1
CO6	-	1	-	1	1	1	1	-	1	1	1	1	1	1	1
AVERAGE	-	1	-	1	1	1	1	1	1	1	1	1	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT 1 – INTRODCUTION **9 Hrs**

Introduction and classification of geometric modeling forms for curves, surfaces and volumes; differential geometry of curves and surfaces; introduction to spline curves; Bezier splines; Uniform/non-uniform Rational B-splines; and fitting, fairing and generalized cylinders.

UNIT 2 – SURFACE GENERATION **9 Hrs**

Curve generation, Ship Curve design, Integration and fairing techniques for curves, Surface representation, Analytical and parametric representation of surfaces, Differential geometry of surfaces

UNIT 3 – SOFTWARE GENERATION AND TESTING **9 Hrs**

Programming and checking for accuracy of area, volumes and various geometrical forms using appropriate programming software.

UNIT 4 – COMPUTER AIDED DESIGN **9 Hrs**

Introduction to blending surfaces; intersection problems in geometric design; offsets of parametric curves, Generation of surfaces and volumes; constructive solid geometry

UNIT 5 – APPLICATION OF CNC **9 Hrs**

Introduction to CNC programming and application, Principles of numerical control, Manual programming, Introduction about preparatory codes (G & M codes)

Total 45 Hrs

Text books

[1] D. F. Rogers and J. A. Adams (1989), Mathematical Elements for Computer Graphics, 2nd edition, Tata McGraw-Hill, India.
[2] G. Farin (2001), Curves and Surfaces for CAGD: A Practical Guide, The Morgan Kaufmann Series in Computer Graphics, 5th edition, Morgan Kaufmann, USA.
[3] Computational Geometry for Ships Edited by: H Nowacki (Technical University of Berlin), M I G Bloor (University of Leeds), B Oleksiewicz (Technical University of Gdansk)

Reference books

[1] N. M. Patrikalakis and T. Maekawa (2010), Shape Interrogation for Computer Aided Design and Manufacturing, Springer.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name:	L	T	P	C
UDNAP05	ADVANCED OFFSHORE ENGINEERING	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week	
Prerequisite course	Elements of Offshore Engineering	(3 Hrs)	

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	Students build upon their knowledge of offshore engineering.

Instructional objectives of the course		
	Students will be able to	
	1	Define the necessary design challenges in offshore system design.
	2	Explain the basis of offshore engineering applied to the design of renewable energy systems.
	3	Make use of an appropriate design of risers and mooring lines for the offshore systems.
	4	Distinguish the pros and cons of the vortex induced vibrations in marine applications.
	5	Importance of the learning of underwater vehicles in design project.
	6	Adapt the learning in developing the offshore design projects.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)		2. MODERATE(MEDIUM)								3. SUBSTANTIAL(HIGH)			

UNIT I –CHALLENGES IN OFFSHORE DESIGN **9 Hrs**

Introduction to ocean environment; Evolution in offshore engineering; Current design trends and challenges; Deepwater exploration and challenges; Subsea field development; Arctic design challenges.

UNIT II –OFFSHORE RENEWABLE ENERGY **9 Hrs**

General – Introduction to ocean energy – wind, wave and current/tides; Offshore wind energy – evolution of design concept, types of foundations and its rigid body motions, design requirements, construction and material;

Wave energy converter – various design concepts and its requirements, material selection; Tidal energy converter – various design concepts and its requirements, material selection. Case study: anyone existing design.

UNIT III –RISER AND MOORING LINES **9 Hrs**

Riser systems: flexible pipe structure and material, typical configurations, top tensioned vertical risers, hybrid risers.

Mooring lines: typical mooring configuration, material and construction, anchors and ancillary equipment, static mooring analysis. Case study: design of anyone type of mooring system.

UNIT IV –VORTEX INDUCED VIBRATION **9 Hrs**

Concept of lift and drag force, parameters influencing the hydrodynamics forces; Flow around a circular cylinder; Vortex formation and associated Vortex Induced Vibration (VIV), vortex shedding, effect of surface roughness; Non-dimensional numbers, selection of Strouhal number; VIV assessment and experimental setup; VIV suppression mechanism; VIV fatigue life calculation; VIV as a fruitful phenomenon.

UNIT V – UNDERWATER VEHICLES **9 Hrs**

Remotely operated vehicles (ROVs): Applications and various design concept, ROV handling systems, construction and materials, navigation and control.

Autonomous underwater vehicle: Applications and design concept, material selection, construction, various sensors and control system. Case study: design of anyone underwater vehicle.

Total 45 Hrs

TEXT BOOKS:

13. Subrata Chakrabarti, Handbook of Offshore Engineering - volume 1, Elsevier Science, Netherlands, June 2005.
14. Subrata Chakrabarti, Handbook of Offshore Engineering - volume 2, Elsevier Science, Netherlands, June 2005.
15. **Clauss**, Günther, **Lehmann**, Eike, **Östergaard**, Carsten, Offshore Structures: Volume I: Conceptual Design and Hydromechanics, Springer - Verlag London Limited, 1992.
16. Gunther Clauss et. al, 1. BC Grewick, Jr. Construction of marine and offshore structure, CRC Press, 2000.
17. Minoo H. Patel, Advanced Offshore Engineering (Offshore Engineering Handbook), BPP Technical Services Ltd., UK, October 1994.

REFERENCES:

13. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
14. RD Blevins, Flow induced vibrations, Van Nostrand Reinhold, 1990.
15. Karimirad, Madjid, Offshore Energy Structures - For Wind Power, Wave Energy and Hybrid Marine Platforms, Springer International Publishing, Switzerland, 2014.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP06	Course Name : Fishing Vessel Technology	**L** 3	**T** 0	**P** 0	**C** 3
Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
				✓	
	Basic Science	Engineering Science	Open Elective	Mandatory	
Aim / Purpose of the course	*To understand the design construction and operation of fishing vessels*				
Instructional objective of the course	Students will be able to				
	1	List the types of fish and different methods of fishing			
	2	Classify the different types of fishing gear			
	3	Make use of preservation of fish on board the vessel			
	4	Categorize the design of different types of fishing vessels			
	5	Explain the materials used in fishing vessel construction and economics of the fishing vessel			
	6	Minimize the Cost Estimation for making the low cost fishing vessel			

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	1	-	-	1	1	1	1	-	1	1	2	1	-	-
CO3	1	2	2	2	1	1	1	1	-	1	1	1	2	2	1
CO4	-	2	-	-	-	1	1	1	-	1	1	1	1	1	1
CO5	-	2	2	2	1	1	1	1	-	1	1	2	2	2	1
CO6	-	1	-	-	1	1	1	-	-	1	1	2	2	2	1
AVERAGE	1	1.6	2	2	1	1	1	1	-	1	1	1.6	1.6	1.7	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION **9 Hrs**

Importance of fishing; Classification of fish for harvesting. Fishing methods – Purse seining, Drift netting, Gillnet fishing. Long line fishing, Pole and line fishing; Trawling, Harpooning.

UNIT II - FISHING GEARS **9 Hrs**

Fishing gear – Towed gear; Bottom trawling; Side trawling; Towing arrangements; stern trawling operations and equipment, multiring trawling, Midwater trawling; analysis of fishing nets.

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UNIT III – FISH HOLD DESIGN **9 Hrs**

Storing and preservation of fish on board a vessel; Fish hold arrangement, Insulation, icing and freezing; Refrigeration machinery.

UNIT IV – VESSEL DESIGN **9 Hrs**

Design of Fishing vessels, Side trawler, Stern trawler, General arrangement, layout and equipment on deck. Determination of main particulars; estimation of components weights generation of ship lines; Resistance & Propulsion calculations

UNIT V – COST ESTIMATION **9 Hrs**

Economics of fishing vessels. Design and economics of simple low cost country fishing craft. Main and auxiliary machinery; Electrical systems; Structural arrangements. Material for construction.

Total 45 Hrs

TEXT BOOKS

1. Design of small fishing vessel, john F. Fyson, Food and agriculture organization of the united nations-1985
2. Fishing boats and their equipment, Dag Pike, 1992.

REFERENCES

3. Fishing boat designs, 3small trawlers, issues 188-191, john f,fyson, Food and agriculture organization of the united nations-1985

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UDNAP07	Course Name :STATUTORY REGULATIONSAND CLASSIFICATION RULES	**L**	**T**	**P**	**C**
		3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week (3Hrs)	
Prerequisite course	NIL		

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the role of IMO and classification societies and the relevance of Codes & Conventions in ship building*

Course Outcome		
	At the end of the course the student should be able to:	
	1	Describe the importance of classification society in Ship building
	2	Explain the IMO conventions
	3	Apply the IMO codes
	4	Categorize the safety survey and draft survey
	5	Evaluate the statutory survey and Periodic survey
	6	Adapt the technical guidelines, rules and regulations which are offered by various classification societies in marine industry.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	1	1	-	-	-	-	1	-	1	1
CO2	2	2	-	-	2	1	2	-	2	-	-	2	-	2	2
CO3	2	2	-	-	2	2	2	-	2	1	-	2	2	2	2
CO4	2	2	-	-	2	1	2	-	2	1	-	2	-	2	2
CO5	2	2	-	-	2	2	2	1	2	2	-	2	2	2	2
CO6	1	1	-	-	1	2	1	2	1	2	-	2	1	2	2
AVERAGE	1.8	1.8	-	-	1.8	1.5	1.6	1.5	1.8	1.5	-	1.8	1.6	1.8	1.8
CORRELATION LEVELS			1. SLIGHT(LOW)			2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO RULES AND REGULATIONS **9 Hrs**

Introduction to Development of Codes & Conventions, Role of Classification societies, rules in ship building - History of Classification society-IACS organization activities, DG shipping, MMD rules, flag, tonnage regulations

UNIT 2 - IMO CONVENTIONS **9 Hrs**

IMO conventions & its relevance to ship construction, Basic concepts of SOLAS, MARPOL, STCW

UNIT 3 - IMO CODES **9 Hrs**

Basic concepts of FSS, LSA,ISM, - FSS and LSA plan –Emergency preparedness and plan

UNIT 4 - CLASS SURVEY **9 Hrs**

Introduction to safety survey, Draft survey-Cargo survey-Refit and operational cycle

UNIT5 -STATUTORY SURVEY **9 Hrs**

Introduction to statutory survey, Periodic survey, Re classification survey, Damage survey

Total : 45 Hours

REFERENCES

1. IMO Publications and Documents
2. IACS Publications and Documents
3. MARPOL and SOLAS Code

Designed by	" Department of Naval Architecture & Offshore Engineering "

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP08	Course Name : INLAND WATER TRANSPORTATION	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	III Year (VI Semester)	Contact hours per week (3 Hrs)	
Prerequisite course	1. Ship Theory 2. Ship resistance and Propulsion		

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand and apply the various steps involved in Inland water transportation and inland water vessel design.*

Instructional objective of the course		
	Students will be able to	
	1	Show the various features of inland water transportation
	2	Explain the facilities required for the inland water transportation.
	3	Model the design of an inland water vehicle for Indian waters with low wash
	4	Functions of the flotilla and pusher tug system
	5	Rule on the structural arrangement of Inland water vessels using classification society rules.
	6	Design the propellers required for Inland water vessels

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)		2. MODERATE(MEDIUM)				3. SUBSTANTIAL(HIGH)							

UNIT I - INTRODUCTION TO INLAND WATER TRANSPORTATION 9 Hrs

Inland waterways and their peculiarities; Maintenance of navigation channels; Siltation, bank erosion and dredging; Indian national waterways.

UNIT II - TRANSPORTATION FACILITIES **9 Hrs**

Inland river ports; Jetties and infrastructural facilities for Intermodal transportation- water, rail and road; Specialized inter modal transportation vessels

UNIT III – INLANDWATER VEHICLE DESIGN **9 Hrs**

Inland water vessels features; Design process; Low wash and low draft self-propelled vessels; dumb barges; flotilla, pusher tugs, passenger ferry, hospital ship.

UNIT IV - STRUCTURAL DESIGN OF INLAND WATER VEHICLES **9 Hrs**

Materials used for Inland water vehicle construction, structural components and scantlings, Classification society rules, registration rules.

UNIT V – PROPULSORS FOR INLANDWATER VEHICLE **9 Hrs**

Selection of propulsion system, Propellers for inland water vessels; Special features-tunnels; Shrouded propellers, water-jet propulsion.

Total 45 hrs

TEXT BOOKS

9. Ship Design Methodologies of Preliminary Design by ApostolosPapanikolaou
10. Practical Ship Design by D.G.M Watson
11. Ship Design for Efficiency and Economy by H. Schneekluth and V. Bertram
12. Ship Design and Construction by R.Taggart

REFERENCES

5. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
6. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAP09	FLUID STRUCTURE INTERACTION	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week (4Hrs)		
Prerequisite course				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To conceptually understand basic phenomenon that control the interaction between simultaneous motion of fluids and solids. Application are found in domain of ship, Aircraft, Offshore Structure.*
Instructional objective of the course	Students will be able to
	1 Defining of Basic Fluid Mechanics
	2 Outline the coupled interaction problem.
	3 Identify the causes and application of vortex induced vibration
	4 Analyze the various causes of instabilities and chaos.
	5 Importance of real-life application of coupling
	6 Minimize the effect of turbulence and wake in coupling

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	2	-	2	-	2	-	-	1	1	-	1	-
CO2	-	1	-	2	1	2	-	2	-	-	1	1	1	2	2
CO3	-	-	2	1	1	2	2	2	2	2	2	2	1	2	2
CO4	-	-	-	1	-	-	-	2	-	-	1	2	1	1	-
CO5	-	-	-	1	-	2	-	2	-	-	2	2	1	1	-
CO6	-	1	1	2	1	2	1	2	-	2	2	2	2	2	2
AVERAGE	-	1	1.5	1.5	1	2	1.5	2	2	2	1.5	1.6	1.2	1.5	2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – INTRODUCTION **9 Hrs**

Basic Fluid mechanics, ideal fluid models, Governing equations – Fluid, structural mechanics, moving frames

UNIT II – VORTEX INDUCED VIBRATION **9 Hrs**

Instability of tube and cylinder arrays– vibrations induced by oscillating flow; vibration induced by turbulence and sound, damping of structures; sound induced by vortex shedding; vibrations of a pipe containing a fluid flow; indices, applications for offshore platforms. Case study-Tacoma bridge (Unsteady effects)

UNIT III - INSTABILITIES **9 Hrs**

Introduction and Overview, Introduction and overview, First Steps in Nonlinear Dynamics, Life and Depth of Dissipative Structures, Non-linear Dynamics: From Simple to Complex, Characterizing and Using Chaos, Nonlinear Dynamics Patterns

UNIT IV – STRONG COUPLING **9 Hrs**

Instabilities induced by drag crisis or lift crisis, -Unsteady effects -Coriolis damping, -Instability of a fluid chord: propagation of stable and unstable waves.

UNIT V – FLOW FORCING **9 Hrs**

-Effects of turbulent separation on obstacles; -Coupling of movement and wake, -Response to flow turbulence.

Total 45 hrs

TEXT BOOKS

- Fluid Structure Interactions, Michael P. Paidoussis, Stuart J. Price, Emmanuel de Langre, December 2010.
- Fluid Structure Interaction: Applied Numerical Methods, Henri J.-P. Morand and Roger Ohayon, 1995
- Flow-induced vibration.2.ed.New York: Van NostrandReeinhold, 1990

REFERENCES

- Bungartz, H. J.; Schäfer, M. (editors). Fluid-structure Interaction: Modeling, Simulation, Optimization. Berlin: Springer, 2006
- BLAKE, W. K. Mechanics of Flow-Induced Sound and Vibration: Complex Flow-Structure Interactions (Applied Mathematics and Mechanics, vol 17. New York: Academic Press, 1986.
- http://www.coursera.org/learn/fluid-solid-interaction.
- http://goo.gl/YKSMnD
- **Onlien Lecture : course on Coursera** (Fundamentals of FSI)

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAP10	SHIP SYSTEMS ENGINEERING	3	0	0	3

Year and Semester	III Year (VI Semester)	Contact hours per week		
Prerequisite course	NIL	(3Hrs)		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand and prepare the components of various Ship Systems and their arrangements*
Instructional objective of the course	Students will be able to
1	List the components involved in different Ship systems
2	Illustrate the hull systems and their arrangements
3	Identify the different engineering systems
4	Inspect the Firefighting system in the ship
5	Assess the design Propulsion and Steering systems
6	Solve a design task of various systems contains in the ship

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	-	-	1	-	-	-	-	-
CO2	1	1	2	1	-	1	1	-	1	-	-	1	1	2	1
CO3	1	1	2	2	-	1	1	-	1	-	-	1	1	2	1
CO4	1	1	2	1	-	1	1	-	1	-	-	1	1	2	1
CO5	-	-	-	-	2	-	1	-	2	2	1	2	1	1	2
CO6	-	1	1	1	-	1	2	2	1	-	1	2	1	2	2
AVERAGE		1	1.7	1.2	2	1.5	1.3	2	1.2	1.5	1	1.4	1	1.8	1.4
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO SHIP SYSTEMS **9 Hrs**

Ship systems- piping system – types, color coding, valves - HVAC system- types of coolants, insulation, Flow measurements, Heat Load, Air changes, pneumatic system- basic function, types of valves, pneumatic/hydraulic system hygiene

UNIT II –HULL SYSTEMS **9 Hrs**

Fresh water system, -RO plant - hydrophore tank, Sanitary system- sewage treatment plant (STP) - deck drains- ballast system and ballast water treatment- deck equipment's- anchor handling system- cargo handling equipment's, Boat Davits, Roll stabilizers, Deck cranes/derricks, anchor cables arrangement.

UNIT III - ENGINEERING SYSTEMS **9 Hrs**

Fuel oil - lubrication oil - starting air compressed air - exhaust - boiler - jacket cooling - oil filters/strainers - oily water separator- scavenging and turbo charger - Anti-vibration - Types of machinery Shock mounts, Engine exhaust. Engine Room Ventilation, Chilled water

UNIT IV –FIRE FIGHTING AND LIFE SAVING SYSTEMS **9 Hrs**

Fire Fighting Appliance (FFA) – life saving appliances (LSA) - fire main system- CO_2 system- bilge system- sludge system,- deck sprinkler

UNIT V - PROPULSION AND STEERING SYSTEM **9 Hrs**

Conventional propulsion system (Prime mover to Propeller including Thrust Block plumber block Gear Box etc.) Electrical propulsion- diesel propulsion system – CODOG, CODAG- power flow schematic- single line layout- steering gear system- stern tube bearing- oil lubricated stern tubes- controllable pitch propeller- thrusters, Active rudder-Dynamic Positioning System.

Total 45 Hrs

TEXT BOOKS

1. G.O.Watson, Marine Electrical Practice,ButterworthHeineman, 1990
2. Harrington L.Roy, Marine Engineering, SNAME Publications, 1992
3. Chirstopher Lavers and Edmund G.R. Kraal , Reed's Vol.7, Advanced Electro technology for marine engineers , 2014

REFERENCES

1. E. A. Fernandez, Marine Electrical Technology, 2014
2. Mukund R. Patel , Electrical Power Systems, , 2012
3. Generation, Transmission and Utilisation of Electrical Power, A.T. Starr , 1957

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE- Naval Architecture & Offshore Engineering				
Course Code UDNAO05	Course Name : INTRODUCTION TO ENGINEERING SIMULATIONS-A HANDS ON PRACTICE	**L**	**T**	**P**	**C**
		3	0	0	3

Year and Semester	III Year (SEMESTER VI)	Contact hours per week (3 Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	
Course Objectives	*To gain the hands on experience in the Engineering Simulations*			

Course Outcome	At the end of the course the students should be able to	
	1	Showing the develop and understanding of the basis of finite-element analysis and computational fluid dynamics
	2	Illustrate the structural analysis problem using simulation software
	3	Apply the concept of fluid dynamics in analysis of fluid and structure problem using CFD
	4	Analyze a mathematical problem underlying simulations in MATLAB and examine the data using graphical visualization
	5	Comparing an existing problem manually and identify the variation using simulation technique
	6	Discuss the problems through report writing and developing technical writing skills

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	1	1	-	-	-	-	1	-	1	1
CO2	2	2	-	-	2	1	2	-	2	-	-	2	-	2	2
CO3	2	2	-	-	2	2	2	-	2	1	-	2	2	2	2
CO4	2	2	-	-	2	1	2	-	2	1	-	2	-	2	2
CO5	2	2	-	-	2	2	2	1	2	2	-	2	2	2	2

CO6	1	1	-	-	1	2	1	2	1	2	-	2	1	2	2
AVERAGE	1.8	1.8	-	-	1.8	1.5	1.6	1.5	1.8	1.5	-	1.8	1.6	1.8	1.8
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – OVERVIEW ON ENGINEERING SIMULATIONS **9 Hrs**

Basics of fluid and solid mechanics, governing equations in CFD and FEA, applications, process – meshing, numerical formulation, solving and data processing, familiarization with CFD and FEA tools. Developments of CFD and FEA applications in industry

UNIT II – BAR AND TRUSS **9 Hrs**

Axial deformation of bars, axial spring element, Analysis of trusses-Two dimensional truss element

FEA Practice – Analysis of 2D stress distribution

UNIT III- BEAM ELEMENT **9 Hrs**

Beam bending-Governing equations for beam bending, two node beam element

FEA Practice – Analysis of uniform beams subjected to distributed and point loads

UNIT IV – STEADY STATE ANALYSIS **9 Hrs**

Explicit and implicit approach - Finite Volume Method – Some conceptual basics and illustrations of 1-D and 2 – D steady problem

CFD Practice – Steady state problem

UNIT V - UNSTEADY STATE ANALYIS **9 Hrs**

Multi-Physics flow, Free surface modelling – interface tracking and interface capturing techniques – CFD in marine applications

CFD Practice – Unsteady state problem

Total 45 Hrs

TEXT BOOKS

1. **John D. Anderson**, *Computational Fluid Dynamics: The Basics with Applications*,1995.
2. **H. Versteeg and W. Malalasekera,***An Introduction to Computational Fluid Dynamics: The Finite Volume Method*, Printice Hall, Second Edition, 2007
3. **C.A.J. Fletcher,***Computational Techniques for Fluid Dynamics, Vol. 1: Fundamental and General Techniques*, 2nd Edition, Springer, 1988
4. **Bhatti, M.A**., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
5. **Reddy, J. N.,** An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
6. **Logan D. L**., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.

REFERENCES

1. **WS Atkins Consultants and Members of the NSC,***Best Practice Guidelines for Marine Applications of Computational Fluid Dynamics*, 2003
2. **Chandrupatla T. R., and Belegundu,** A. D., Introduction to Finite Elements in Engineering, Prentice Hall,

2003

3. CFD Software manuals for marine applications

NPTEL Lectures

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAO06	Course Name : FISHING VESSEL AND WORKBOAT DESIGN	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	III Year (SEMESTER VI)	Contact hours per week (3Hrs)
Prerequisite course	NIL	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	*To understand design of fishing vessel and work boat*
Instructional objective of the course	Students will be able to
1	Shows the importance of fishing
2	Explains the storing and preservation of fish onboard
3	Modelling the basic design of fishing vessel and work boat
4	Explanation of the main particulars of the fishing vessel
5	Design the lines plan and calculation of resistance and propulsion.
6	Formulate the Resistance & Propulsion calculations

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	1	-	-	1	1	1	1	-	1	1	2	1	-	-
CO3	1	2	2	2	1	1	1	1	-	1	1	1	2	2	1
CO4	-	2	-	-	-	1	1	1	-	1	1	1	1	1	1
CO5	-	2	2	2	1	1	1	1	-	1	1	2	2	2	1
CO6	-	1	-	-	1	1	1	-	-	1	1	2	2	2	1
AVERAGE	1	1.6	2	2	1	1	1	1	-	1	1	1.6	1.6	1.7	1
CORRELATION LEVELS		1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION **9 Hrs**

Importance of fishing; Classification of fish for harvesting.

UNIT II - FISHING HOLD **9 Hrs**

Storing and preservation of fish on board a vessel; Fish hold arrangement, Insulation, icing and freezing; Refrigeration machinery..

UNIT III - VESSEL DESIGN **9 Hrs**

Design of Fishing vessels, Design of a work boat. General arrangement, layout and equipment on deck.

UNIT IV - MAIN PARTICULARS **9 Hrs**

Detrmination of main particulars; estimation of components weights.

UNIT V - PROPULSION **9 Hrs**

Generation of ship lines; Resistance & Propulsion calculations. Material for construction.

Total 45 Hrs

TEXT BOOKS

4. Design of small fishing vessel, john F. Fyson, Food and agriculture organization of the united nations-1985
5. Fishing boats and their equipment, Dag Pike, 1992.

Designed by	" Department of Naval Architecture & Offshore Engineering"				
PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	**L**	**T**	**P**	**C**
UDNAO07	OCEAN OBSERVATION AND INSTRUMENTATION TECHNIQUES	3	0	0	3

Year and Semester	III Year (SEMESTER VI)	Contact hours per week	
Prerequisite course	NIL	(3Hrs)	
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	To learn about the ocean observing systems and measurement techniques which has a central role to deliver the ocean services to the society.	
Instructional objective of the course	At the end of the course the students will be able to	
	1	List the hydrographic survey methods
	2	Classify the different ocean observation systems
	3	Identify the global climate change and the influence of ocean
	4	Analyze the use of different observation and measurement devices
	5	Evaluate the different measurement techniques used for ocean observation
	6	Compile the data and image processing methods

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	1	1	1	-	-	-	-	-	-	1	1
CO2	-	1	-	1	1	1	1	-	-	-	-	-	-	1	1
CO3	-	1	-	-	1	1	1	1	1	1	-	1	1	1	1
CO4	-	1	-	1	1	1	1	1	-	-	1	1	1	1	1
CO5	-	1	-	1	1	1	1	1	-	-	1	1	1	1	1
CO6	-	1	-	1	1	1	1	-	1	1	1	1	1	1	1
AVERAGE	-	1	-	1	1	1	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION **9 Hrs**

Hydrographic survey, gravitational and magnetic surveys. Ship borne and air borne surveys, Coastal navigation: Navigation warnings. Coastal marks and buoys, sounding, tides and tidal streams. Visual fixing. Fixing by radar and radio aids to navigation.

UNIT II – OCEAN AND OBSERVATION TECHNIQUES **9 Hrs**

Ocean's role in climate change, ocean and global carbon cycle, Technologies for sea observation and monitoring (waves, currents, bathymetry, wind); monitoring of water chemical and physical parameters; technology and techniques for oil spill detection and analysis; Ocean and future climate change

UNIT III – MEASUREMENT TECHNIQUES **9 Hrs**

Measurement techniques, sensors and instruments: Sensors for tide, wave, salinity, temperature, water current & direction, underwater radiation. Pressure sensors, Acoustic sensors, Strain gauge type, Sensors for ship borne, air borne and buoys

UNIT V - OCEAN COMMUNICATION SYSTEMS **9 Hrs**

Marine radios and regulations, radar, direction finders, Decca/ Loran systems, satellite position fixing systems, GPS and DGPS, Electronic marine safety instruments: Direction finding floating beacons, EPIRB, equipment for marine surveillance

UNIT V – DATA AND IMAGE PROCESSING **9 Hrs**

Data processing and storage: Raw and processed positional data. Storage systems and methods, Data presentation, charts, electronic and graphic presentation, Mapping, airborne and satellite imaging, Interpretation, analyses and processing systems, Digital image processing

TEXT BOOKS

1. Instrumentation Measurement and Analysis –B.C Nakra and Choudhry
2. Measurement Systems and Applications, Earnest O. Deobelin, McGraw Hill, 1st edn. 1997
3. Instrumentation – Systems and Devices, Rangan& Sharma, Tata McGraw Hill, 1st Edn., 1997

REFERENCE BOOKS

1. Instruction Manual for Oceanic Observations, U.S. Naval Oceanographic Office, N.Y., 2001
2. Instrument Methods of Analysis, Willard, Merrit& Dean, C B S Pub., 1st edn., 1992

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA6PA	Course Name : MARINE HYDRODYNAMICS LABORATORY	L	T	P	C
		0	0	2	1

Year and Semester	III Year (VI semester)	Contact hours per week (2Hrs)
Prerequisite course		

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	To understand the experimental techniques in the model making. 1.To understand the techniques involved in model making and model testing
Course Outcome	After completion of the course, the students will be able to 1. Demonstrate the model making techniques available for floating bodies – with practical exposure to model making 2. Explain the values of different resistance parameters manually 3. Justify basic experiments related to ship hydrodynamics 4. Criticize Resistance with the available data 5. Explain involved in a propeller design 6. Select stem and stern hull forms

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO 3
CO1	1	1	-	-	1	-	2	3	1	2	1	1	3	3	3
CO2	3	2	1	-	2	1	1	1	-	-	2	-	3	3	3
CO3	3	2	2	-	2	1	1	1	-	-	2	-	3	3	3
CO4	2	2	1	-	1	1	-	2	1	2	2	-	3	3	3
CO5	2	2	1	1	1	2	-	-	1	2	3	1	3	3	3
CO6	3	2	1	2	3	2	1	1	1	3	2	2	3	3	3
AVERAGE	2.3	1.8	1.2	1.5	1.6	1.4	1.25	1.6	1	2.25	2	1.33	3	3	3

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

Model Making Techniques, Calibration of instruments, analysing the geometrically similar ship model, determination of CG of the Ship model, Inclining Experiment, estimating the Radius of Gyration of a Ship Model, Model preparation for resistance and sea keeping tests, IITC standards of model tests, Method of IITC 1978 resistance prediction method **Total : 30 Hours**
REFERENCES 1. Practical Ship Hydrodynamics. Volker Bertram, Butterworth-Heinemann, 2000 Dynamics of Marine Vehicles, R Bhattacharya, 1978
Designed by — " Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA6PB	Course Name : OFFSHORE STRUCTURE DESIGN – SOFTWARE LABORATORY	L	T	P	C
		0	0	2	1
Year and Semester	III Year (VI Semester)	Contact hours per week (2 Hrs)			
Prerequisite course					
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. To learn the design procedure for the fixed offshore structure using the given design software.				
Course Outcome	After completion of the course, the students will be able to 1. Create model of the given Jacket platform in software. 2. Analyze the structure under various conditions. 3. Analyze the structure under various loads. 4. Find suitable conditions to geometrically frame jacket platform. 5. Interpret and validate the results. 6. Create a semisubmersible with topside.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	2	1	-	-	1	1	2	1	1	2	2	2
CO2	-	-	-	2	2	1	-	1	-	-	2	-	3	3	3
CO3	-	-	-	2	2	1	-	1	-	-	2	-	3	3	3
CO4	-	-	-	2	1	1	-	1	1	2	2	-	3	3	3
CO5	-	-	-	2	1	2	-	1	1	2	3	1	3	3	3
CO6	-	-	-	2	3	2	-	1	1	3	2	2	3	3	3
AVERAGE	-	-	-	2	1.6	1.4	-	1	1	2.25	2	1.3	2.8	2.8	2.8
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)							3. SUBSTANTIAL(HIGH)			

Brief introduction to Offshore structure design principles and calculations Introduction to software and its modules, Familiarization with the GUI Introduction to the Jacket Structure modelling, Structural analysis of the structure - Creation of sections, selection of materials and thickness of the plates, Creation of bottom structure like legs, horizontal bracings, vertical bracings, risers, conductors and stubs, Creation of top structure using I-sections and plates stiffeners, girders and decks and placing equipment like generator, crane, blankets on the deck, Creation of wind loads and displacement loads. Analyzing the structure by using linear structural analysis method. **Total 30 Hrs**
TEXT BOOKS 1. Software modules by DNV GL Sesam (Genie v7.1) **REFERENCES** 1. Software modules by DNV GL Sesam (Genie v7.1)

Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER – VII

PROGRAM	BE-Naval Architecture & Offshore Engineering															
Course Code: UDNA701	Course Name : Advanced Ship Technology							L	T	P	C					
								3	0	0	3					
Year and Semester	IV Year (semester VII)							Contact hours per week (3Hrs)								
Prerequisite course	NIL															
Course category	Humanities and Social Sciences		Management courses					Professional Core		Professional Elective						
								✓								
	Basic Science		Engineering Science					Open Elective		Mandatory						
Course Objective	1. Comprehending the role of IMO in maritime sectors 2. Inculcating the basic applications of Codes and Conventions Familiarizing the standard surveys to be undertaken in maritime sector															
Course Outcome	After completion of the course, the students will be able to: 1. Recall the importance of classification society in Ship building 2. Recall IMO conventions 3. Recall IMO codes 4. Recall safety survey and draft survey 5. Recall statutory survey and Periodic survey 6. Apply technical guidelines, rules and regulations which are offered by various classification societies in marine industry.															

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	2	3	-	1	2	1	-	-	2	-
CO2	-	-	-	-	2	-	-	-	-	-	2	-	-	3	-
CO3	-	-	-	-	2	-	-	-	-	-	2	-	-	3	-

CO4	-	-	-	-	1	-	-	-	1	2	2	-	-	3	-
CO5	-	-	-	-	1	-	-	-	1	2	2	-	-	3	-
CO6	-	-	2	2	3	-	1	3	1	3	3	2	2	3	2
AVERAGE	-	-	2	2	1.7	2	2	3	1	3	2	2	2	2.8	2
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO RULES AND REGULATIONS **9 Hrs**

Introduction to Development of Codes & Conventions, Role of Classification societies, rules in ship building - History of Classification society-IACS organization activities, DG shipping, MMD rules, flag, tonnage regulations.

UNIT II - IMO CONVENTIONS **9 Hrs**

IMO conventions & its relevance to ship construction, Basic concepts of SOLAS, MARPOL, STCW.

UNIT III - IMO CODES **9 Hrs**

Basic concepts of FSS, LSA, ISM - FSS and LSA plan – Emergency preparedness and plan.

UNIT IV - CLASS SURVEY **9 Hrs**

Introduction to safety survey, Draft survey-Cargo survey-Refit and operational cycle.

UNIT V - STATUTORY SURVEY **9 Hrs**

Introduction to statutory survey, Periodic survey, Re-classification survey, Damage survey.

Total: 45 Hours

TEXTBOOKS:

1. MARPOL and SOLAS Code.

REFERENCES:

1. IMO Publications and Documents.
2. IACS Publications and Documents.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	**L**	**T**	**P**	**C**
UDNAP11	ADVANCED SHIP DESIGN	3	0	0	3

Year and Semester	IV Year (VII Semester)	Contact hours per week	
Prerequisite course	1. Ship Design	(3 Hrs)	

Course category	Course category	Humanities and Social Sciences	Management courses	Professional Core
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To learn about detailed ship design process and understand the functional requirements of ship during design stages*	
Instructional objective of the course	Students will be able to	
	1	Select machinery and propulsion system.
	2	Illustrate the piping system
	3	Model the Capacity plan, Accommodation and other plans with respect to the Statutory Requirements
	4	Examine the electrical, navigation and communication equipment selection
	5	Estimate the building cost
	6	Propose the shipbuilding contract

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1

AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - SHIP DRAWINGS AND PLANS **9 Hrs**

General arrangement Plan, generation of lines plan – methods, Class and Statutory drawings

UNIT II - MACHINERY SELECTION, INSTALLATION AND PROPULSION SYSTEM **9 Hrs**

Selection of Main Machinery, Selection of propeller, Selection of Rudder and Steering Gear, Selection of Auxiliary Machinery

UNIT III – PIPING SYSTEMS AND OUTFITTING **9 Hrs**

Design of piping systems, Ballast and bilge water piping system, fuel oil system, fresh water system, seawater system, Deck outfitting items, bollards, chocks, fair leads

UNIT IV –BASICS OF ELECTRICAL, NAVIGATION AND COMMUNICATION EQUIPMENT SELECTION **9 Hrs**

Electrical powering calculations, Sea load, Harbour load, Selection of Generators, Emergency generators, Switch boards, Power distributions, Cabling and other equipment, navigation and communication equipment, lighting requirements in accommodation and other important compartments.

UNIT V - COST ESTIMATION **9 Hrs**

Ship design and Ship building cost - cost of material, machinery and propulsive installation, accommodation/equipment/outfitting, labour and overheads, Tender Document Preparation, TNC, PNC, contract documentation clauses, stage payment, Force Majeure, liquidity damage- mandatory document with contract-milestones, stage payment etc.

Total 45 hrs

TEXT BOOKS

1. Practical Ship Design by D.G.M Watson
2. Ship Design and Construction by R.Taggart

REFERENCES

1. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP12	Course Name: COMPUTER AIDED STRUCTURAL DESIGN (FEA)	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Course category	Humanities and Social Sciences	Management courses	Professional Core
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Aim / Purpose of the course	*To understand the fundamentals of the ship structural analysis using numerical methods such as finite element method*			
Instructional objective of the course	Students will be able to			
	1	Tell the basic understanding of the structural problem-determinate and indeterminate structure		
	2	Contrast the concept of virtual work and energy-based methods to solve structural problems		
	3	Apply the Structural methods used for solving structural problems leading to computer application such as finite element method		
	4	Importance of finite element method and its application		
	5	Adapt the finite element method to ship structure		

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	1	-	-	1	1	1	1	-	1	1	2	1	-	-
CO3	1	2	2	2	1	1	1	1	-	1	1	1	2	2	1
CO4	-	2	-	-	-	1	1	1	-	1	1	1	1	1	1
CO5	-	2	2	2	1	1	1	1	-	1	1	2	2	2	1
CO6	-	1	-	-	1	1	1	-	-	1	1	2	2	2	1
AVERAGE	1	1.6	2	2	1	1	1	1	-	1	1	1.6	1.6	1.7	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO SHIP STRUCTURAL ANALYSIS **9 Hrs**

Basic concepts; Types of structure; Force displacement relationship; Statical and kinematic indeterminacy; Assumptions, objectives and general approach in ship structural analysis.

UNIT II - ENERGY BASED METHODS **9 Hrs**

Principles of virtual works; Castiglione's theorems; Other energy-based methods; Introduction to flexibility and stiffness matrix method; formation of equation.

UNIT III - MATRIX METHODS **9 Hrs**

Determination of member and joint displacements; Equivalent joint loads, Stiffness matrix; Deformation matrix; Member and overall stiffness matrices. Boundary conditions; Effect of temperature variations; lack of fit etc.

UNIT IV – FINITE ELEMENT METHOD **9 Hrs**

Introduction to finite element method; Advantages and disadvantages, Beam element; plane stress; plate bending; use of conforming elements.

UNIT V - FEM APPLICATIONS TO SHIP STRUCTURES **9 Hrs**

Application of FEM to ship structures; deck beams and deck girders; frames; double bottoms; bulkheads; deck and side shell.

Total 45 Hrs

TEXT BOOKS

1. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Wiley, 2005.
2. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
3. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.

REFERENCES

1. Chandrupatla T. R., and Belegundu, A. D., Introduction to Finite Elements in Engineering, Prentice Hall, 2003

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAP13	SUBSEA PIPELINE AND RISERS	3	0	0	3

Year and Semester	IV Year (VII Semester)	Contact hours per week	
Prerequisite course	NIL	(3Hrs)	

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To gain knowledge on risers, offshore pipeline design, piping components, piping material take off preparation and installation methods*

Course Outcome		
	Students will be able to	
	1	Tell the offshore pipeline and riser configurations
	2	Show the functions of pipeline and riser components
	3	Apply the offshore pipeline and risers under various conditions
	4	Inspect the design criteria and considerations for offshore pipeline and riser systems
	5	Evaluate the pipeline commissioning and operations.
	6	Design the submarine pipelines.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO2	1	1	-	-	-	-	1	-	-	-	-	1	1	1	-
CO3	1	1	-	-	1	1	1	1	-	1	1	1	1	1	1
CO4	1	1	2	2	1	2	2	1	1	1	1	1	1	1	1
CO5	1	1	-	2	1	2	2	1	1	2	1	1	1	1	1
CO6	1	-	2	2	-	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	2	2	1	1.5	1.6	1.2	1	1.2	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)			2. MODERATE(MEDIUM)				3. SUBSTANTIAL(HIGH)						

UNIT I - INTRODUCTION TO SUBMARINE PIPELINES **9 Hrs**

Introduction Pipeline, offshore pipe line- - Process Diagrams (PFD, P&ID); Codes and Standards for offshore pipeline; Pipeline Elements (Fittings, valves and instruments), Piping material selection. Material Take off for offshore pipelines. Pipeline Drawings (Field layouts, Alignment sheet, Crossing details and Trench details),

UNIT II - PIPELINE DESIGN **9 Hrs**

General Design Information - Pipeline design procedure- Design Cycle ; Route Selection and Diameter ,Wall Thickness calculation - Internal Pressure, External Pressure, Temperature ;. Hydrodynamic Stability of Pipelines- Pipeline Span - Dynamic Span – Vortex Induced Vibrations and Fatigue; Operating Stresses; Pipeline External Corrosion Protection ; Pipeline Insulation

UNIT III - SUBMARINE PIPELINE INSTALLATION **9 Hrs**

Pipeline survey and mapping, Pipeline route engineering; Pipeline Installation Methods.- Installation Bending Stress Control; Pipeline On-Bottom Stability Control

UNIT IV - PIPELINE COMMISSIONING AND OPERATIONS **9 Hrs**

Pipeline construction for cross country and offshore systems focusing on welding, Pressure testing, pre-commissioning, and commissioning, Pipeline integrity aspects including in-line inspection, Leak detection and emergency planning considerations. Flow assurance; Pigging Operations.

UNIT V - RISERS AND DESIGN COSIDERATIONS **9 Hrs**

Riser – different types of risers ; Riser components, Riser Bends, Riser Clamps; Different riser configurations; riser failure modes; structural riser analysis; static and dynamic riser analyses; riser design criteria and considerations.

Total 45 hrs

TEXT BOOKS

1. Offshore Pipelines - By Dr. Boyun Guo -University of Louisiana at Lafayette, Shanhong Song ChevronTexaco Overseas Petroleum Company ,Jacob Chacko, INTEC Engineering, Inc. ,Dr. Ali Ghalambor University of Louisiana at Lafayette.
2. George A. Antaki Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair
3. M L Nayyar, Piping handbook
4. Boyun Guo, Shanhong Song, Jacob Chacko,Ali Ghalambor, Offshore Pipelines
5. Shashi Menon, Piping Calculations Manual (McGraw-Hill Calculations)– December 10, 2004
6. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, Springer-Verlag
7. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.

REFERENCES

1. Peter Smith ,The Fundamentals of Piping Design (Process Piping Design) (v.1) Hardcover – April 15, 2007
2. M. W. Kellogg, "Design of Piping Systems Paperback – July 6, 2011
3. Subrata K. Chakrabarti " Hand book of Offshore engineering " . Offhore structural analysis , Inc. volume II ELSEVIER (2005)

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP14	Course Name : DYNAMICS OF OFFSHORE STRUCTURE	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Course category	Humanities and Social Sciences	Management courses	Professional Core
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Aim / Purpose of the course	*To understand the dynamic characteristics and its application to offshore conditions*			

Instructional objective of the course	At the end of the course the students will be able to	
	1	List the dynamic characteristics of fixed and floating offshore structures
	2	Explain the basic concepts involved in the structural dynamics and their governing equations.
	3	Solve the equations of motion and evaluate the response under various loading condition for SDOF
	4	Analyze the equations of motion for MDOF system, estimate natural frequencies and mode shapes
	5	Appraise the concepts of structural dynamics to offshore structures.
	6	Test the response of the offshore structure using numerical integration technique.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1

CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I –FUNDAMENTALS OF DYNAMICS **9 Hrs**

Introduction to different types of ocean structures - Environmental forces -Structural action of ocean structures, Basic features of dynamic loading and response – models for dynamic analysis – lumped mass, generalized displacements, Degrees of freedom – Translational and rotational systems - mass moment of inertia.

UNIT II – SINGLE DEGREE OF FREEDOM SYSTEM **9 Hrs**

Free vibration - Equation of motion, Damped free vibration, critically damped, under damped and over damped systems, Negative damping.

Forced vibration - Response to harmonic loading, magnification factor, Undamped and damped system,Comparison in response build up. Response to periodic loading -Fourier series expansion - response to Fourier series loading, Exponential form of Fourier series loading and response- Complex frequency transfer functions, Formulation of equation of motionto numerical problems

UNIT III – MULTI-DEGREE OF FREEDOM SYSTEM **9 Hrs**

Equations of motion and response of free and forced (harmonic) vibration - Natural frequencies and mode shapes, Eigenvalues and eigenvectors - Orthogonality of modes, Stodola, Rayleigh-Ritz and influence coefficient methods, Dunkerley - Matrix methods for dynamic analysis -Modal response method - Modal mass contribution, Problems - Duhamel's integrals**.**

UNIT IV – STRUCTURAL RESPONSE OF OFFSHORE STRUCTURES **9 Hrs**

Introduction to Fluid-structure interaction, Mathematical idealization, formulation of Equation of motion, response of Jacket Structure, Articulated Tower, Tension Leg platform.

UNIT V – DYNAMIC ANALYSIS **9 Hrs**

Dynamic analysis of fixed and floating offshore structures, Numerical integration technique - Newmark-Beeta, Runge-Kutta methods. Structural health monitoring of offshore platforms using Wireless Sensor Networking (WSN)

Total 45 Hrs

TEXT BOOKS

1. Anil K. Chopra. 2003. Dynamics of structures: Theory and applications to earthquake Engineering: Pearson Education, Singapore.
2. ArvidNaess and TorgeirMOan. 2013. Stochastic dynamics of marine structures, Cambridge University Press, New York, USA.

REFERENCES

1. Clough,R.W. and Penzien, J., Dynamics of structures, McGraw Hill, 1993Seakee
2. Meirovitch L., Elements of Vibration Analysis, Mc.Graw Hill, 1986
3. James F. Willson, Dynamic of offshore structure, John Wiley & Sons Inc.
4. S 1893 – Criteria for Earthquake Resistant Design of Structures, 2002.
5. SP 22: Explanatory Handbook on Codes for Earthquake Engineering.

6. Meirovitch L., Elements of Vibration Analysis, Mc.Graw Hill, 1986.
7. Thomson W.T., Theory of Vibration with Applications, Pearson Education Inc., 1998.
8. Craig, Jr. R.R., Structural Dynamics, John Wiley, 1981.
9. Hurty, W.C. and Rubinstein M.F., Dynamics of Structures, Prentice Hall, 1964.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	**L**	**T**	**P**	**C**
UDNAP15	Vibration of floating structures	3	0	0	3

Year and Semester	IV Year (VII Semester)	Contact hours per week		
Prerequisite course	NIL	(3Hrs)		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand the fundamentals of the ship vibration and use knowledge for proper selection of engine and propeller. use the knowledge gained to design the structure and design of instrument and machinery mounts for reducing effects of harmful dynamic effects*
Instructional objective of the course	Students will be able to
	1 Define a dynamic system
	2 Interpret the mathematical aspects of single degree freedom free and force vibration systems
	3 Apply the mathematical aspects of multi degree freedom free and force vibration systems
	4 Analyze the mathematical aspects of continuous system free and force vibration systems introduction to ship vibration
	5 Assess the ship vibration system
	6 Propose the selection of engine and propeller details

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION **9 Hrs**

Dynamic analysis; Representation of a system; fluctuating force or forcing function as input; response of a system to the input; Classification of forces; mathematic representation of the forces.

UNIT II - SINGLE DEGREE FREEDOM SYSTEMS **9 Hrs**

Mechanical system; Equivalent stiffness; Equivalent mass; spring-mass-dashpot system; Single degree freedom system (SDF); free vibration of undraped SDF system; forced vibration of undamped SDF system; forced damped SDF system.

UNIT III – MULTI – DEGREE FREEDOM SYSTEMS **9 Hrs**

Two degree freedom system; free and forced vibration of two degree freedom system; multi degree freedom system. Method of mode summation.

UNIT IV – SHIP HULL VIBRATION **9 Hrs**

Continuous system; Holzer's method, Mjkyle Stadt method; Concept of added mass in ship hull vibration; Schlick's formula; Todd's formula; Kamai's formulas SR94 expression; Stodola's method for ship hull vibrations.

UNIT V - DESIGN CONSIDERATIONS **9 Hrs**

Estimate of $N_{2v,}$ N_{2H} and higher mode frequencies; Hull Resonance Diagram; Selection of Engine rpm; Selection of number of Blades on a Propeller; Engine Mount Design; Location finding for electronics instrument on-board -a vessel; if required structural rearrangement.

Total 45 Hrs

TEXT BOOKS

1. Mechanical vibration by Thompson
2. Principle of Naval architecture vol II by Edward v Lewis

REFERENCES

2. Ship structural design by Owen Hughes
3. Introductory course on theory and practice od mechanical vibration by JS RAO & GUPTA

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAP16	High Performance Marine Vehicles	3	0	0	3

Year and Semester	IV Year (VII Semester)	Contact hours per week	
Prerequisite course	NIL	(3Hrs)	

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course	*To understand the design and performance of high performance marine vehicles*

Instructional objective of the course		Students will be able to
	1	List the different types of high-performance marine vehicles
	2	Illustrate the design high speed displacement craft
	3	Model the design of planning craft
	4	Classify the types and design of air cushion vehicles
	5	Explain the design of surface effect ships
	6	Develop the design of special crafts

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO HIGH SPEED CRAFTS **9 Hrs**

Classification of high performance vehicles; Comparison of vehicles on the basis of power, sea keeping & economics; Special design feature of high performance vehicles; Materials for high performance vehicles; structural design consideration; propulsion machineries and propulsion devices.

UNIT II - DISPLACEMENT CRAFT DESIGN **9 Hrs**

High speed displacement craft; Design procedure; Estimation of power; System design consideration

UNIT III – PLANING CRAFT **9 Hrs**

Planing phenomena; estimation of power; hull from design; Hydrofoil craft; foil types and configuration; design of foils; stability when foil borne; propulsion consideration.

UNIT IV - AIR CUSHION VEHICLES **9 Hrs**

Types of air cushions and their effectiveness; cushion sealing arrangement; resistance in calm water and in waves. Propulsion and maneuvering arrangements.

UNIT V – SPECIAL CRAFTS **9 Hrs**

Surface effect ships; high speed catamarans; Trimaran; Hybrid craft.

Total 45 Hrs

TEXT BOOKS

6. Performance by design: Hydrodynamics for high speed vessel
7. IMO high speed craft codes
8. Hydrodynamics of high speed marine vehicles By OM faltinsen 2005

REFERENCES

4. Principles of Naval Architecture vol II

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE - Naval Architecture & Offshore Engineering				
Course Code UDNAP17	Course Name: Marine Corrosion and Control	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)	Contact hours per week (3 Hrs)		
Prerequisite course	Electro chemistry			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course

Instructional objectives of the course

Students will be able to

1	Define corrosion mechanism and failure
2	Contrast the corrosion Inspection and maintenance
3	Utilize the corrosion protection by protective coatings
4	List the application of corrosion inhibitors
5	Select cathodic and anodic protection systems
6	Estimate corrosion life and select suitable methods of corrosion protection

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	1	-	-	1	1	1	1	-	1	1	2	1	-	-
CO3	1	2	2	2	1	1	1	1	-	1	1	1	2	2	1
CO4	-	2	-	-	-	1	1	1	-	1	1	1	1	1	1
CO5	-	2	2	2	1	1	1	1	-	1	1	2	2	2	1
CO6	-	1	-	-	1	1	1	-	-	1	1	2	2	2	1
AVERAGE	1	1.6	2	2	1	1	1	1	-	1	1	1.6	1.6	1.7	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I- CORROSION FAILURE **9 Hrs**

Introduction – Corrosion , types and modes of corrosion failures , mechanism of corrosion ,factures affecting corrosion , Guidelines for investigating corrosion failures , Prevention of corrosion damage – Methods – Corrosion Testing

UNIT II : CORROSION MAINTENANCE THROUGH INSPECTION AND MONITORING 9 Hrs

Material selection -Introduction of properties of materials. Acceleration and managing corrosion damage. Smart sensing of corrosion with fiber optics ,Nondestructive evaluation (NDE)

UNIT III : **PROTECTIVE COATINGS 9 Hrs**

Coating and coating process, Supplementary Protection systems. Coating materials and properties –Paint coating, metal coating etc. . Surface preparation, Rules and regulations for application of coating, Coating Surveys.

UNIT IV : CORROSION INHIBITORS : 9 Hrs

Classification of inhibitors , Corrosion inhibition mechanism , Selection of an inhibitor system

UNIT V:CATHODIC AND ANODIC PROTECTION 9 Hrs

Sacrificial Anode CP systems, Impressed Current Systems, Monitoring and Performance of CP systems for marine structures. Anodic Protection – Equipment required for anodic protection, Design concerns.

Project : Modeling and Life prediction for corroded surfaces

Total 45 hrs

TEXT BOOKS

1. Hand Book of Corrosion Engineering by Pierre R.Roberge McGraw –Hill Publication
2.Hsu, H.T. 1981.Applied Offshore Structural Engineering: Gulf Publishing Co., Houston
3. . Corrosion and Protection,Engineering Materials and Processes, ISSN 1619-0181, Springer Science & Business Media, 2004

REFERENCE

1.API-RP2A. 1989. Recommended Practice for Planning, Designing and Constructing, Fixed Offshore Platforms: 18th edn. American Petroleum Institute, Washington, D.C.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP18	Course Name : THEORY AND PRACTICES OF MARINE CFD	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Aim / Purpose of the course	*To gain knowledge on the governing equations, discretization, formulation and solution techniques involved in CFD and further learn and practice the applications of CFD in marine industry*			
Instructional objective of the course	At the end of the course the students should be able to			
	1	Define the wide applications of CFD and its recent advancements in marine industry		
	2	Illustrate the working principle of CFD – Pre-Processor, Solver and Post-Processor		
	3	Apply the governing equations used in CFD in integral and differential forms		
	4	Analyze the general errors and uncertainties in CFD simulations		
	5	Explain the importance and applications of CFD in Naval Architecture stream		
	6	Create some examples of CFD simulations applicable for marine industry		

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	1	1	1	1	-	1	1	-	1
CO2	-	1	2	1	-	1	1	1	1	1	1	1	1	1	1
CO3	-	1	1	1	1	1	1	-	1	1	1	1	1	1	1
CO4	-	2	2	1	-	2	1	1	1	1	1	1	1	1	1
CO5	-	2	2	1	-	1	1	1	1	1	1	1	1	1	1
CO6	-	-	1	1	-	1	1	1	1	1	1	1	1	1	1
AVERAGE	-	1.5	1.6	1	1	1.2	1	1	1	1	1	1	1	1	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I - INTRODUCTION TO CFD CONCEPTS **9 Hrs**

Introduction to CFD, Working principle of CFD – Pre-Processor, Solver, Post-Processor – problem solving with CFD - models of flow – finite control volume, infinitesimal fluid element – substantial derivative - Reynold's transport theorem

UNIT II - GOVERNING EQUATIONS **9 Hrs**

Governing equations: conservation principle, mass conservation in three dimension, momentum equation in three dimensions, Navier Stokes equation for a Newtonian fluid – conservative form of the governing equations – integral and differential forms of governing equations - general form of conservation equations

UNIT III - PARTIAL DIFFERENTIAL EQUATIONS (PDE) **9 Hrs**

Introduction, Classification of partial differential equations, The Eigen value method – Behaviour of PDE's; impact on CFD – hyperbolic, parabolic and elliptic equations – Initial and boundary conditions – Dirichlet and Neumann.

UNIT IV - FUNDAMENTALS OF DISCRETIZATION **9 Hrs**

Discretization concept, discretization techniques – Finite Difference Method, Explicit and implicit approach - Finite Volume Method – Some conceptual basics and illustrations of 1-D steady problem – Basics on solution Algorithms - Basics on turbulence modelling

UNIT V - CFD IN MARINE APPLICATIONS AND PRACTICE **9 Hrs**

Free surface 166odeling – interface tracking and interface capturing techniques – Grid independence analysis – CFD in marine applications – Examples; wave pattern calculations for steady ship flow, ship resistance estimation, seakeeping and maneuvering simulations – Further developments of CFD applications in marine industry, Practical sessions

Total 45 Hrs

TEXT BOOKS

1. **John D. Anderson**, *Computational Fluid Dynamics: The Basics with Applications*,1995.
2. **H. Versteeg and W. Malalasekera,***An Introduction to Computational Fluid Dynamics: The Finite Volume Method*, Printice Hall, Second Edition, 2007
3. **C.A.J. Fletcher,***Computational Techniques for Fluid Dynamics, Vol. 1: Fundamental and General Techniques*, 2nd Edition, Springer, 1988

REFERENCES

4. **WS Atkins Consultants and Members of the NSC,***Best Practice Guidelines for Marine Applications of Computational Fluid Dynamics*, 2003
5. CFD Software manuals for marine applications
6. NPTEL Lectures

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP19	Course Name : SHIPYARD PRACTICE AND PROJECT MANAGEMENT	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory
Course Objectives	*To understand the various Shipyard Practices related to quality and production and to attain a good knowledge on project management and planning*			

Course Outcome		
	Students will be able to	
	1	List the various aspects related to the Shipyard practices
	2	Illustrate the principle involved in the production, management and planning
	3	Develop and explain shipyard layout and productivity
	4	Dissect and schedule a ship construction/repair project
	5	Evaluate the Industrial Relations and Personnel Management
	6	Propose the General Project Planning, Project Scheduling

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	2	2	2	1	1	1	1	-	-	1	1
CO2	-	-	-	-	1	1	1	1	1	1	1	-	-	1	1
CO3	-	-	-	-	-	-	-	2	2	1	1	-	-	2	2
CO4	1	1	2	1	2	2	2	1	2	2	1	2	2	2	1
CO5	1	1	2	-	2	2	2	2	1	2	1	1	1	2	1
CO6	-	1	2	1	1	2	2	1	2	2	-	2	2	2	1
AVERAGE	1	1	1.7	1	1.6	1.8	1.8	1.3	1.5	1.5	1	1.6	1.6	1.6	1.1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO SHIP YARD ACTIVITIES 9 Hrs

Organizational Structure of Shipyards, Functional Departments of Shipyard- Production, Planning, Material, Financial, HR and Administration, Yard Utility, Various activities in Shipyard- Shipbuilding and Ship Repair

UNIT II - SHIP BUILDING PROCESS **9 Hrs**

General Process Planning, Principles of Design for Production, Production based structural assembly plan, Process Planning-Scheduling , Monitoring and Controlling, Material Planning and Contol, Quality Assurance Process in Shipyard- (Reciept Inspection, Test Certificates, Online quality Checks, QA format/check list preparation, Class Survey), Basin /Sea Trials and Delivery formalities

UNIT III – SHIPYARD LAYOUT AND PRODUCTIVITY **9 Hrs**

Shipyard Capacity Planning- Productivity in Shipyard- Measurement and Monitoring, Shipyard Capacity estimation, Role of process and procedure in Shipyard Capacity evaluation, Shipyard Layout- Factors affecting, design of shipyard layout, Production facility layout, Some aspects of Shipyard Capacity augmentation, Developing Shipbuilding Strategy.

UNIT IV - PROJECT MANAGEMENT **9 Hrs**

General Project Planning, Project Scheduling, Application of models for process planning, scheduling and control - Gantt charts, CPM & PERT, Scheduling and Resource planning, Ship Repair Project Planning- Work Package (Direct and ancillary work), Work Scheduling, Monitoring. Planning tools- MS Project, Primavera

UNIT V – INDUSTRIAL AND HUMAN RELATIONS **9 Hrs**

Shipyard Management- Industrial Relation, Personnel Management, Human Relations and its importance, Contract Management, Managing Owners and Classification Society, Managing Vendors and subcontractors, CSR activities, Labour laws and regulatory bodies

Total 45 hrs

TEXT BOOKS

1. Storch R. Lee, Hammon C.P. & Bunch H.M..; Ship Production, Cornell Maritime Press, Maryland, USA, 1988
2. Taggart; ship design and construction, SNAME chapter 15, 1980
3. Buffa, Modern production operations management, 6th edition, Wiley 1980

REFERENCE BOOKS

1. Eyres D.J.; Ship Construction William Heinemann Ltd, London, 1982
2. Dormidontov V. K. & et.al; Shipbuilding Technology, Mir publishers, Moscow

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Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAP20	Course Name : GUIDANCE AND CONTROL OF MARINE VEHICLES	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (VII Semester)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Aim / Purpose of the course		
Instructional objective of the course	At the end of the course the students should be able to	
	1	Defining a numerical model for the control of marine vehicles
	2	Demonstrate the different control requirements involved in surface ship and underwater vehicle dynamics
	3	Identify different types of ROVs and their operations
	4	Dissect the closed loop feedback control diagrams for marine vehicles
	5	Explain the stability characteristics of surface ship and underwater vehicles
	6	Adapt the fundamentals involved in automatic control and dynamics positioning

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	1	2	-	1	-	1	1	-	1	-
CO2	1	1	-	-	1	1	2	-	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
CO4	1	1	-	-	-	-	1	2	1	1	1	1	1	1	1
CO5	1	1	-	1	-	1	1	2	1	1	1	1	1	1	1
CO6	1	1	-	-	1	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	1	1	1	1	1.6	1.7	1	1	1	1	1	1	1
CORRELATION LEVELS		1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

UNIT I – MARINE VEHICLE DYNAMICS **9 Hrs**

Kinematics of moving frames; coordinate transformation, Newtonian and Lagrangian Mechanics; Rigid Body Dynamics; Hydrodynamics Forces and Moments; Environmental Disturbances; Ocean Currents

UNIT II – CONTROL SYSTEM FUNDAMENTALS **9 Hrs**

Introduction – plants, inputs and outputs, the need for modelling, basic components of a control system, open-loop and closed loop control systems, Block diagrams, Laplace transform, representation of linear systems – transfer function, state-space form, conversion of state space and transfer function representations, PID controllers - Proportional only, Proportional-Derivative only, Proportional-Integral-Derivative – Benefits and drawbacks

UNIT III - CONTROLLABILITY OF SURFACE SHIPS **9 Hrs**

Controllability, surface vessel linear model, Types of stability, stability of the sway/yaw system, Analysis of course keeping, basic rudder action in sway/yaw model, various maneuvers, Introduction to nonlinear equations.

UNIT IV – CONTROLLABILITY OF UNDERWATER VEHICLES **9 Hrs**

ROV overview, operational goals, classification, Flow characteristics for standard operations, Types of ROV services, Design theory – Vehicle design, stability and control, Standards and specifications, propulsion systems

UNIT V – AUTOMATIC CONTROL SYSTEMS **9 Hrs**

Adaptive autopilots, Course keeping with automatic control, Automatic controls of unstable vessels, Unstable ship – limits and difficulties, Input data and time lag effects, Dynamic Positioning Systems
Project: *Numerical modelling of surface ship or underwater vehicle control*

Total 45 hrs

TEXT BOOKS

18. **Fossen, T.** *Guidance and Control of Ocean Vehicles.* New York, NY: John Wiley & Sons, 1994.
19. ***Lewis, E.V.*** *Principles of Naval Architecture - Vol III Motions in Waves and Controllability*, 2nd edition, The Society of Naval Architecture and Marine Engineers, Jersy City, NJ, 1989
20. **Ogata, K.** *Modern Control Engineering.* 4th ed. Upper Saddle River, NJ: Prentice Hall, *2001.*
21. **Robert D. Christ and Robert L. Wernli, Sr.** *The ROV Manual - A User Guide for Remotely Operated Vehicles*, 2nd ed. Elsevier, 2014

REFERENCES

1. **Perez, T.** *Ship Motion Control - Course keeping and roll stabilization using rudder and fins*, Springer-Verlag London Limited, 2005.
2. **Fossen, T.** *Handbook of Marine Craft Hydrodynamics and Motion Control*, John Wiley& Sons. LTD, 2011.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code	Course Name :	L	T	P	C
UDNAP21	WARSHIP TECHNOLOGY	3	0	0	3

Year and Semester	IV Year (VII Semester)	Contact hours per week	
Prerequisite course	NIL	(3Hrs)	
Course category	General		

Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
				✓
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objectives	*To understand the various aspects of Warships and submarines, it's types, capabilities, arrangements, standards.*

Course Outcome	Students will be able to
1	Relate the Warship and Submarine projects-design and constructions.
2	Explain various aspects related to the Warships and Submarines
3	Construct the General arrangement of warships
4	Examine the control systems
5	Estimate the value of development of warships
6	Plan to join in the Indian Navy or a PSU as a career option for the students

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	1	-	-	1	1	1	1	-	1	1	2	1	-	-
CO3	1	2	2	2	1	1	1	1	-	1	1	1	2	2	1
CO4	-	2	-	-	-	1	1	1	-	1	1	1	1	1	1
CO5	-	2	2	2	1	1	1	1	-	1	1	2	2	2	1
CO6	-	1	-	-	1	1	1	-	-	1	1	2	2	2	1
AVERAGE	1	1.6	2	2	1	1	1	1	-	1	1	1.6	1.6	1.7	1

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)

UNIT I: INTRODUCTION TO WARSHIPS **9 Hrs**

Utility Concept of warships, Type of Warships, Classification of warships and their functions,

UNIT II: GENERAL ARRANGEMENT **9 Hrs**

Various decks and arrangements, Weapons positioning, magazines, Hull, Engineering, Electrical and weapon equipment, accommodation, Bridge navigation system etc.

UNIT III: DESIGN AND CONSTRUCTION OF WARSHIPS **9 Hrs**

Design spiral, rules for classification , Warship specifications and standards, Vibration, Shock, Subdivision, damage, Electronical Interactions, FW system, SW system, Weapon systems, Anchor chain cable system, towing and mooring arrangements, HVAC, Cold and Cool Room system, NBC warfare, Citadel, ATUs/AHUs, ER arrangements, Auxiliary machinery, Generators, Emergency generator, Masts, Lights, human fatigue. Stealth considerations for design

UNIT IV: FRIGATES AND DESTROYERS **9 Hrs**

Role of these Ships, Advantages of general purpose ship, Advantages of General Purpose Ship, Advantages of Specialist Vessels, Typical Frigate Profile, Weapon Systems Selection, Communication Systems, Typical Weapon Systems, Integration of Ship, Sensors and weapon systems, Overall ability and effectiveness of a warship, Weapons and fighting Capabilities, Creating a fighting Ship, Propulsion Machinery.

UNIT V: SUBMARINE DESIGN AND CONTROL SYSTEMS **9 Hrs**

Types of submarines, Utility Concept of submarines, GA of submarine, The basic design process, Characteristics and development of submersibles, The environment, Materials, Hydro mechanical principles, Structural principles, Submersible vehicles support systems, Design and operating safety, Rules for classification of submarines, commercial submarines.

Total 45 hrs

TEXT BOOKS

1. Rawson & Tupper, Basic Ship Theory, Vol 2 George A. Antaki Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair
2. EE Allimendinger, Submersible vehicle systems design. SNAME, 1990.
3. Modern Warship Design and Development by Norman Friedman

REFERENCES

1. Naval Forces, Jane's Fighting Ships
2. Naval Forces, Naval Weapon Systems
3. Naval Forces, Navy International
4. Journal of Naval Engineers.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAO08	Course Name : INTRODUCTION TO UNDERWATER TECHNOLOGY	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (SEMESTER VII)	Contact hours per week (3 Hrs)	
Prerequisite course	NIL		

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	*To obtain a basic knowledge on different underwater technologies such as exploration, subsea pipeline and underwater vehicles*

Instructional objective of the course		
	At the end of the course the students will be able to	
	1	List the various challenges involved in the underwater exploration
	2	Explain the importance of ocean resources
	3	Make use of the national developments in underwater exploration of resources
	4	Inspect the different pipeline methods and their installation with respect to subsea applications
	5	Importance of different underwater vehicles and their operations
	6	Develop the various sensors and navigation systems used for underwater applications

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	2	2	2	1	1	1	1	-	-	1	1
CO2	-	-	-	-	1	1	1	1	1	1	1	-	-	1	1
CO3	-	-	-	-	-	-	-	2	2	1	1	-	-	2	2
CO4	1	1	2	1	2	2	2	1	2	2	1	2	2	2	1
CO5	1	1	2	-	2	2	2	2	1	2	1	1	1	2	1
CO6	-	1	2	1	1	2	2	1	2	2	-	2	2	2	1
AVERAGE	1	1	1.7	1	1.6	1.8	1.8	1.3	1.5	1.5	1	1.6	1.6	1.6	1.1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I – MARINE RESOURCES **9 Hrs**

Introduction, Challenges in deep sea, Seafloor characteristics, Physical properties of sea water. Effects of density, salinity and temperature on sound speed, Ocean resources, classification, potential uses of sea, Mineral and hydrocarbon resources

UNIT II – UNDERWATER EXPLORATION **9 Hrs**

Exploration, development, Underwater Sound Channels, Underwater instruments for positioning, signal transfer and mapping, production of hydrocarbons, deep sea mining – national developments

UNIT III – SUBSEA PIPELINE AND RISERS **9 Hrs**

Introduction subsea pipeline, Pipeline Elements, Piping material selection, Pipeline survey and mapping, Pipeline route; Pipeline Installation Methods. Riser – different types of risers

UNIT IV – INTRODUCTION TO UNDERWATER VEHICLES **9 Hrs**

Introduction, Unmanned marine vehicles – Applications, Unmanned surface vehicles, Unmanned underwater vehicles – Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs), Classification, Types of ROV services, Operations, Type of propulsions, Design theory – Vehicle design and stability

UNIT V - UNDERWATER NAVIGATION & SENSING SYSTEMS **9 Hrs**

Vehicle sensors ; Function of sensors, Types of sensors, Sensor Categories Vehicle navigation sensors, Flux gate compass, Tether turn counter, Pressure-sensitive depth gauge, Obstacle avoidance sonar, Altimeter, Inclinometer, Vehicle lighting

Total 45 Hrs

TEXT BOOKS

1. **G.Neumann & WJ Pierson, Jr**., *Principles of Physical Oceanography*, Prentice Hall,1st edn.,1966.
2. **E S Cassdy**, *Introduction to Energy Resources, Technology and Society* :, Elsevier, 1st edn., 2000.
3. **D S Cronon,** *Underwater Minerals*, Academic Press, 1st edn., 1980.
4. **Robert D. Christ and Robert L. Wernli, Sr.** *The ROV Manual - A User Guide for Remotely Operated Vehicles*, 2nd ed. Elsevier, 2014

REFERENCES

5. **Borges & Ginsburg**, *Ocean Year Book (Vol 1 – 4)*, The University of Chicago Press, 1983.
6. **Ghosh & Mukhopadyay**, *Mineral Wealth of the Ocean*, Oxford & IBH Pub. Co., 2nd, 1999

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAMME	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAO09	Course Name : Pipeline and Riser Engineering	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	IV Year (SEMESTER VII)	Contact hours per week (3Hrs)		
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objectives	*To gain knowledge on risers, offshore pipeline design, piping components, piping material take off preparation and installation methods*	
Course Outcome	Students will be able to	
	1	Defining the offshore pipeline and riser configurations
	2	Explain the functions of pipeline and riser components
	3	Develop the offshore pipeline and risers under various conditions
	4	Evaluate the design criteria and considerations for offshore pipeline and riser systems
	5	Assess the pipeline commissioning and operations.
	6	Improve the Design aspects of offshore pipelines.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	1	1	1	-
CO2	1	1	-	-	-	-	1	-	-	-	-	1	1	1	-
CO3	1	1	-	-	1	1	1	1	-	1	1	1	1	1	1
CO4	1	1	2	2	1	2	2	1	1	1	1	1	1	1	1
CO5	1	1	-	2	1	2	2	1	1	2	1	1	1	1	1
CO6	1	-	2	2	-	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	2	2	1	1.5	1.6	1.2	1	1.2	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT I - INTRODUCTION TO OFFSHORE PIPELINES **9 Hrs**

Introduction Pipeline, offshore pipe line- - Codes and Standards for offshore pipeline; Pipeline Elements (Fittings, valves and instruments), Piping material selection(PMS). Material Take off for offshore pipelines. Pipeline Drawings (P&ID ,Field layouts, Alignment sheet, Crossing details and Trench details),

UNIT II – BASIC DESIGN PARAMETERS AND PROCEDURES **9 Hrs**

General Design Information - Pipeline design procedure- Design Cycle ; Route Selection and Diameter ,Wall Thickness calculation - Internal Pressure, External Pressure, Temperature . Pipeline External Corrosion Protection; Pipeline Insulation;. Introduction to Flexible Pipelines; Pipeline Supports and Clamps

UNIT III – ANALYSIS AND INSTALLATION OF PIPELINES **9 Hrs**

Pipeline survey and mapping, Pipeline route engineering; Pipeline Installation Methods.- Installation Bending Stress Control. Hydrodynamic Stability of Pipelines- Pipeline Span - Dynamic Span – Vortex Induced Vibrations and Fatigue; Operating Stresses

UNIT V - RISER AND COMPONENTS **9 Hrs**

Riser – different types of risers ; Riser components, Riser Bends, Riser Clamps; Different riser configurations; riser failure modes; structural riser analysis; static and dynamic riser analyses; riser design criteria and considerations.

UNIT IV - PIPELINE OPERATIONS AND INSPECTIONS **9 Hrs**

Pipeline construction for cross country and offshore systems focusing on welding, Pressure testing, pre-commissioning, and commissioning, Pipeline integrity aspects including in-line inspection, Leak detection and emergency planning considerations. Flow assurance; Pigging Operations.

Total 45 Hrs

TEXT BOOKS

8. Offshore Pipelines - By Dr. Boyun Guo -University of Louisiana at Lafayette, Shanhong Song ChevronTexaco Overseas Petroleum Company ,Jacob Chacko, INTEC Engineering, Inc. ,Dr. Ali Ghalambor University of Louisiana at Lafayette.
9. George A. Antaki Piping and Pipeline Engineering: Design, Construction, Maintenance, Integrity, and Repair
10. M L Nayyar, Piping handbook
11. Boyun Guo, Shanhong Song, Jacob Chacko,Ali Ghalambor, Offshore Pipelines
12. Shashi Menon, Piping Calculations Manual (McGraw-Hill Calculations)– December 10, 2004
13. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, Springer-Verlag
14. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.

REFERENCES

4. Peter Smith ,The Fundamentals of Piping Design (Process Piping Design) (v.1) Hardcover – April 15, 2007
5. M. W. Kellogg, “Design of Piping Systems Paperback – July 6, 2011
6. Subrata K. Chakrabarti “ Hand book of Offshore engineering “ . Offhore structural analysis , Inc. volume II ELSEVIER (2005)

Designed by	“ Department of Naval Architecture & Offshore Engineering”

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNAO10	Course Name : HULL INSPECTION	**L**	**T**	**P**	**C**
		3	0	0	3

Year and Semester	IV Year (SEMESTER VII)	Contact hours per week (3 Hrs)		
Prerequisite course				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Aim / Purpose of the course	*To have fair awareness of Survey procedure and its relevance and to adopt protective measures and monitor hull condition with respect to corrosion*
Instructional objective of the course	Students will be able to
	1 List the strength and grades of shipbuilding steel
	2 Explain the various failure modes of Ship structural elements
	3 Make use of IACS standards for ship construction and repairs
	4 Inspect the welder certification process
	5 Evaluate the hull inspection during ship repairs
	6 Improve the hull protective coatings and protection against corrosion

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	1	2	-	1	-	1	1	-	1	-
CO2	1	1	-	-	1	1	2	-	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
CO4	1	1	-	-	-	-	1	2	1	1	1	1	1	1	1
CO5	1	1	-	1	-	1	1	2	1	1	1	1	1	1	1
CO6	1	1	-	-	1	1	2	2	1	1	1	1	1	1	1
AVERAGE	1	1	1	1	1	1	1.6	1.7	1	1	1	1	1	1	1
CORRELATION LEVELS			1. SLIGHT(LOW)				2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

UNIT 1 – INTRODUCTION TO HULL MATERIAL AND ITS RELEVANCE IN SURVEY 9 Hrs

Types of Ships; Overview of Materials for Shipbuilding; Types of Ship building Steel- Grade; Purpose /utility of high grade; Scantling of ship and its relevance in survey of Ship, relevance of shell expansion drawing in hull survey.

UNIT II - FUNDAMENTALS OF HULL SURVEY **9 Hrs**

Need for hull survey; Periodicity of Hull survey, Types of Hull survey, Methods of hull survey - Visual, Hammer, Ultrasonic thickness gauging, Ultrasonic survey. Method of recording Survey findings, Hull Structural failure modes- Buckling, fatigue, corrosion; Survey Report

UNIT III – HULL STRUCTURAL SURVEY DURING CONSTRUCTION **9 Hrs**

Hull Structural standards, IACS standards, Ship Building Standards, Ship Repair Standards (Recap)
Classification Survey during Construction- Steel traceability, Inspection of welders and welder certification. Stage wise survey of structure- Dry survey procedure (Include Dimensional and Diagonal checks) and corrective action.

UNIT IV – SALIENT FEATURES OF SURVEY DURING SHIP REPAIR **9 Hrs**

Hull Survey during ship repair, Hull defect Survey – Survey of U/w hull external, u/w hull internal structures, Survey of inaccessible areas, Survey of Wet compartment, Inspection of load carrying welded hull fitting. Critical areas of inspection prone to corrosion and deterioration, Recoding of Survey remarks- Survey Report

UNIT V- HULL PROTECTION AND MONITORING **9 Hrs**

Hull Corrosion Protection system, Fundamentals of protective coating, Defects and effects of coatings, Differential Corrosion, Preferential corrosion, Galvanic Cell, Sacrificial Anodes - Types, ICCP system, Underwater Inspection and Hull survey, Survey of Sacrificial Anodes, Survey of ICCP system components.

Total 45 Hrs

TEXT BOOKS

1. Eyres,D.J , Ship construction,1994

2. Taylor,D.A, Merchant ship construction ,2002

3. Kemp, Ship construction ,2002

4. Pursey,H.J , Merchant ship construction ,2002

REFERENCES

1. Guide for hull inspection and maintenance program ABS

2. Ship Surveys and Inspection, Great Britain, National Audit Office.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA7PB	Course Name : Numerical Ship Hydrodynamics – Software Laboratory	L	T	P	C
		0	0	2	1

Year and Semester	IV Year (semester VII)		Contact hours per week (2Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. Layout the preprocessing plan and execute it. 2. Defining the computational domain and environmental conditions. 3. Performing the post-processing and inference from the results.
Course Outcome	After completion of the course, the students will be able to: How to approach ship hydrodynamic problem numerically using CFD approach Recall the basic theory behind the software Design a model on the software Criticize the values manually which was as given as a output Estimate the numerical problems in Naval Architecture such as ship resistance, Estimate the numerical problems in Naval Architecture such as ull propeller interaction and motion studies

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	-	3	2	1	-	1	2	2
CO2	2	2	1	1	1	-	-	-	3	2	1	-	1	2	2
CO3	2	2	1	3	2	-	1	2	2	2	1	-	1	2	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	2	2	1	1.7	1.3	-	1	2	2.6	2	1	-	1	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

Introduction to the software and its capabilities, General overview of CFD process and its application in ship hydrodynamics, Familiarization with the GUI, Importing the CAD model, generation Virtual Towing Tank, Boundary conditions, Meshing strategies, solver parameters, post processing the results.

Numerical experiments:

Marine Resistance Prediction

Marine propeller in Open water
Self-Propulsion test
Motion studies in Head Sea condition

Total: 30 Hours

TEXTBOOKS:

1. WS Atkins Consultants and Members of the NSC, Best Practice Guidelines for Marine
2. Applications of Computational Fluid Dynamics, 2003

Software manual.

REFERENCES:

1. John D. Anderson, Computational Fluid Dynamics: The Basics with Applications, 1995.

Designed by	" Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code:	Course Name :	L	T	P	C
UDNA7PC	Mini Project	0	0	2	1

Year and Semester	IV Year (semester VII)		Contact hours per week (4Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective	1. Implementing the self-understanding about technical and non-technical backgrounds. 2. Practicing the skills of managing the time-bounded attributes of the projects. Learning how things could be executed within time.
Course Outcome	After completion of the course, the students will be able to: 1. Explain the pre-requisites for executing any basic project. 2. Show the skill of presentation 3. Develop a report by him/her 4. Apply the ideas penned down during the initial phase of the projects. 5. Summarize the outcomes in the systematically laid out pattern to comprehend effectively. 6. Judge the procedure based on the outcomes of the projects.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	1	1	2	2	2	1	2	2	2
CO2	3	3	1	1	2	2	2	-	1	2	1	2	2	2	2
CO3	3	3	1	2	1	2	1	-	1	2	1	-	2	2	2
CO4	3	3	1	2	3	2	2	2	1	3	2	1	2	2	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVERAGE	3	3	1	1.5	2	1.75	1.5	1.5	1.25	2.25	1.5	1.3	2	2	2
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

A student will be asked to undergo a technical/non-technical project supervised by the faculty member. Guidelines for the same have framed by the department.

Total: 60 Hours

TEXTBOOKS: N/A

(not limited to any topics) **REFERENCES:** N/A (not limited to any topics)
Designed by — " Department of Naval Architecture & Offshore Engineering"

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code UDNA7PA	Ship System Drawing & Launching Calculations Laboratory	L	T	P	C
		0	0	2	1
Year and Semester	IV Year (semester VII)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. Understanding the key features of the piping systems in ships 2. Developing the skills for ship's GA 3. Familiarizing with the ship's launching calculations				
Course Outcome	After completion of the course, the students will be able to: 1. Develop Ship systems for a given data 2. Develop fire and safety plans 3. Develop pipe design diagram 4. Develop fluid systems of ship 5. Develop Anchor and mooring 6. Develop launching calculations and curves				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	1	3	2	1	-	3	3	3
CO2	2	2	1	1	1	-	-	1	3	2	1	-	3	3	3
CO3	2	2	1	1	1	-	1	1	3	2	1	-	3	3	3
CO4	2	2	1	1	1			1					3	3	3
CO5			1	1				1					3	3	3
CO6			1	1				1					3	3	3
AVERAGE	2	2	1	1	1	-	1	1	3	2	1	-	3	3	3
CORRELATION LEVELS		1. SLIGHT(LOW)				2. MODERATE(MEDIUM)						3. SUBSTANTIAL(HIGH)			

SHIP SYSTEM DRAWING

HVAC Schematic diagram ,Pipe Design- Piping diagram for fluid systems of a ship.(Sanitary supply &

discharge, Fuel oil system, lube oil system, Sea water cooling and fresh water cooling, compressed air system, Bilge and ballast system, drain pipe internal /external, etc.) ,Air ventilation system

FIRE AND SAFETY PROTECTION (ONE SYSTEM DRAWING)

Structural fire protection plan, Fire control and safety plan, Arrangement of life saving plan, Equipment calculation and selection of Anchor and Mooring, Anchor arrangement, mooring arrangement

LAUNCHING PLAN CALCULATION

End launching calculations, end launching curves, Launching tests.

Total: 30 Hours

TEXTBOOKS:

1. Principle of Naval Architecture by Edward V.Lewis, Volume- III.

REFERENCES:

1. Robert Taggard, Ship Design & Construction.
2. Eric c. Tupper, Introduction to Naval Architecture.

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA7PD	Course Name : Internship - II	L	T	P	C
		0	0	0	1

Year and Semester	IV Year (semester VII)		Contact hours per week (N/A)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
			✓	
	Basic Science	Engineering Science	Open Elective	Mandatory

Course Objective

1. Comprehending the classroom learning by practicing real time in industry.
2. Learning how things could be executed within time.

Course Outcome

After completion of the course, the students will be able to:

1. Create correlation between what is taught during the classes and the industry practices.
2. Explain procedural aspects of the project being undertaken in the industry.
3. Explain the experience of their own.
4. Explain the importance of the stay/work in the industry.
5. Compare gained in the classroom-based learning to fulfill the tasks given during the internship.
6. Improve the classroom based learning through the internship experience.

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO2	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO3	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO4	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-
AVERAGE	-	-	-	-	-	-	-	2	-	-	-	-	2.5	2.5	2.5
CORRELATION LEVELS		1. SLIGHT(LOW)					2. MODERATE(MEDIUM)					3. SUBSTANTIAL(HIGH)			

A student must undergo an internship for a minimum period as prescribed by the department in the relevant field of Naval Architecture or Offshore Engineering.

Total: N/A

TEXTBOOKS: N/A (not limited to any topics) **REFERENCES:** N/A (not limited to any topics)	
Designed by	" Department of Naval Architecture & Offshore Engineering"

SEMESTER – VIII

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA8PA	Course Name : Major Project / Industry Internship Project	L	T	P	C
		-	-	22	11
Year and Semester	IV Year (semester VIII)	Contact hours per week (22 Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
			✓		
	Basic Science	Engineering Science	Open Elective	Mandatory	
Course Objective	1. Implementing the self-understanding about technical and non-technical backgrounds. 2. Practising the skills of managing the time-bounded attributes of the projects. 3. Learning how things could be executed within time.				
Course Outcome	After completion of the course, the students will be able to: 1. Explain the pre-requisites for executing any basic project. 2. Show the skill of presentation 3. Develop a report by him/her 4. Apply the ideas penned down during the initial phase of the projects. 5. Summarize the outcomes in the systematically laid out pattern to comprehend effectively. 6. Judge the procedure based on the outcomes of the projects.				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	1	2	2	2	2	1	3	3	3
CO2	3	3	1	1	2	2	2	2	1	2	1	2	3	3	3
CO3	3	3	1	2	1	2	1	2	1	2	1	-	3	3	3
CO4	3	3	1	2	3	2	2	2	1	3	2	1	3	3	3
CO5	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
CO6	-	-	-	-	-	-	-	2	-	-	-	-	3	3	3
AVERAGE	3	3	1	1.5	2	1.75	1.5	2	1.25	2.25	1.5	1.3	3	3	3

CORRELATION LEVELS	1. SLIGHT(LOW)	2. MODERATE(MEDIUM)	3. SUBSTANTIAL(HIGH)
A student will be asked to undergo a technical/non-technical project supervised by the faculty member. Guidelines for the same have framed by the department.			
TEXTBOOKS: N/A (not limited to any topics) **REFERENCES:** N/A (not limited to any topics)			
Designed by	" Department of Naval Architecture & Offshore Engineering"		